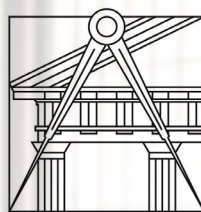




UNIVERSIDADE
DE LISBOA



FACULDADE DE ARQUITETURA

UNIVERSIDADE DE LISBOA

SAVING SPACE WITH FURNITURE DESIGN
Focusing on worldwide micro living and the traditional Japanese home as case-studies

MASTER'S DISSERTATION
for the attainment of the Master degree in Product Design

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ABSTRACT

This thesis focuses in increasing the useful living space of any home, to improve the quality of life of its inhabitants. This comes as a response to two problems: the lack of flexibility of Western-styled rooms, which limits the amount of social and private activities able to do inside home, and the unjust low quality of life of the inhabitants of small homes. Small homes are a reality anywhere there is lack of space. Overpopulation in the biggest cities of the world causes lack of space and increases house prices. If nothing changes, either there won't be any room for anyone else to settle down, or living conditions will worsen.

This research will focus primarily on storage design that can relieve the house of excessive furniture. It's purposes, aimed for the general population, will be on finding how to: relieve the overtired population from household chores and need for space; improve our relationship with our home by decreasing the amount of obstruction and maintenance and increasing the amount of enjoyable private and family time; provide a solution to having a comfortable, multi-functioning, small family home.

We will present research on worldwide examples of storage solutions for saving space, micro homes' interiors and daily habits. The Japanese traditional home will be a case study wherein the focus will be primarily on the bareness of space and the floor sitting customs. To understand the different traditional living customs and usage of rooms, there is a comparison between the history of the Western and the Japanese furniture.

To identify the problems related to our home interiors, we will resource to a non-interventionist research methodology of observation (with plenty of bibliographic literature and case studies) and of survey (with the making of an inquiry using quantitative and qualitative bases of evaluation). The survey results will allow for interpretation as to which solutions are more recommended for each space-saving case.

The conclusions show interesting furniture concepts and home layouts that result from mixed worldwide lifestyles and values. The results must take into consideration solutions for the various types of Western housing construction in which they must be integrated (be it standard or micro homes), as well as be accessible and desirable for every economic class.

KEYWORDS

Micro Homes | Smart Homes | Japanese Furniture | Floor/*Tatami* Storage | Flexible Rooms

RESUMO

Esta tese foca-se no aumento do espaço útil em qualquer casa, de forma a melhorar a qualidade de vida dos seus habitantes. Este foco surge como resposta a dois problemas: a falta de flexibilidade nas divisões de estilo ocidental, o que limita a quantidade de actividades possíveis de fazer dentro de casa, sejam elas sociais ou privadas; e a injusta e baixa qualidade de vida de habitantes de casas pequenas. A sobrepopulação nas maiores cidades do mundo provoca falta de espaço e aumenta o preço das casas. Se nada for feito as cidades não conseguirão receber mais pessoas ou então a qualidade de vida dos seus habitantes terá de ser sacrificada.

Esta dissertação focar-se-á principalmente em design de armazenamento que possa reduzir a quantidade excessiva de mobiliário na casa. Os objectivos deste tipo de mobiliário são direccionados para um público geral e reflectem como: auxiliar a população fatigada de tarefas domésticas e de necessidade de espaço; melhorar a nossa relação com a nossa casa reduzindo a quantidade de obstrução e manutenção e aumentando a quantidade de tempo de qualidade familiar e privado; encontrar uma solução que concilie ter uma casa familiar que seja confortável e multi-funcional.

Apresentamos pesquisa de exemplos em todo o mundo de soluções para o aproveitamento de espaço, interiores de micro casas e hábitos de utilização de espaço. A casa tradicional japonesa será usada como um caso de estudo, com um foco na nudez do espaço e no hábito de sentar no chão. É feita uma comparação entre a história do mobiliário, ocidental e japonês, para compreender os diferentes hábitos de vida e utilizações do espaço.

Para ajudar a identificar os problemas relacionados com o interior das nossas casas, recorrer-se-á a uma metodologia não-intervencionista de observação (com bastante revisão literária e estudos de casos) e de pesquisa (com a criação de um inquérito que use avaliações de base quantitativa e qualitativa). Os resultados do inquérito darão uma interpretação de quais as soluções mais recomendadas para cada caso de aproveitamento de espaço.

Os resultados reflectem-se em conceitos de mobiliário interessantes e disposições de divisões de casas, resultantes de uma combinação de estilos de vida e valores de todo o mundo. Estes resultados têm em consideração os diversos tipos de construção de casas ocidentais, nas quais podem ser integrados, sendo também acessíveis e desejáveis para todas as classes económicas.

PALAVRAS-CHAVE

Micro Casa | Casa Inteligente | Mobiliário Japonês | Arrumação no Chão | Quartos Flexíveis

LIST OF ACRONYMS AND ABBREVIATIONS

B.C. Before Christ (used in indicating dates).

ca. Circa (in dates).

cm. Centimeter.

CO² Carbon dioxide.

etc. Et Cetera (and so on).

n.d. No date.

PhD Doctor of Philosophy. Also called doctorate. The highest degree awarded by a graduate school, usually to a person who has completed at least three years of graduate study and a dissertation approved by a board of professors.

UNESCO United Nations Educational, Scientific, and Cultural Organization.

GLOSSARY

| | | | |
|--------------------|---|-----------------------|---|
| Bon | Tray. | Irori | Sunken hearth, sunken fireplace. |
| Byobu | Folding Screen. | Iyo-sudare | Iyo bamboo screen, rattan blind. |
| Cha-dansu | Tea storage cabinet. | Kagu | Furniture. |
| Chabudai | Low dining table. | Kamakura | Kamakura period (1185-1333). |
| Datsuzoku | Unworldliness, saintliness. | Kanso | Simplicity, plain. |
| Endai | Bench. | Katei | Katei era (1235.9.19-1238.11.23). |
| Engawa | Veranda, porch, balcony, open corridor. | Kofun | Kofun period (300-552). |
| Fukinsei | Asymmetry. | Koshikake | Seat, bench. |
| Fusuma | Japanese sliding screen. | Kotatsu | Table over an electric heater (orig. a charcoal brazier in a floor well) with a hanging quilt that retains heat. |
| Geta | Japanese wooden clogs. | | |
| Genkan | Entryway to a Japanese house where street shoes are removed and house shoes put on before entering the house. | Kutsunigi ishi | Shoe removal stone placed in a genkan or next to an engawa (veranda). |
| | | Manmaku | Curtain, drapery. |
| Heian | Heian era (794-1185). | Meiji | Meiji era (1868.9.8-1912.7.30). |
| Horigotatsu | Low, covered table placed over a hole in the floor of a Japanese-style room. | Momoyama | Momoyama Period (1573-1615). |
| | | Muromachi | Muromachi (era 1392-1573, or 1333-1573, or 1336-1573). |

GLOSSARY

| | | | |
|------------------|--|------------------|--|
| Mushiro | Woven mat (esp. one made of straw). | Tansu | Chest of drawers; bureau; cabinet; dresser. |
| Noren | (Short) sign curtain hung at shop entrance. | Tatami | Japanese straw floor coverings. |
| Ofuro | Bath. | Tsuitate | Partitioning screen. |
| Oshiire | Closet. | Wabi sabi | The beauty to be found in poverty and simplicity; subdued taste; quiet refinement; sober refinement. |
| Seijaku | Silence, stillness, quietness. | Washi | Japanese paper. |
| Shibui | Austere; elegant (and unobtrusive); refined; quiet (and simple); sober; sombre; subdued; tasteful (in a quiet way); understated. | Zaisu | Small chair used while sitting on <i>tatami</i> . |
| Shiraki | Plain wood; unfinished woodwork. | Zataku | Low table. |
| Shitsurai | Equipment; installation; facilities; arrangements. | Zen | Small dining table (usu. for a single person); serving tray (with legs); Zen (Buddhism). |
| Shoin | Traditional style of Japanese residential architecture. | | |
| Shoji | Paper sliding door. | | |
| SRO | Single Room Occupancy. | | |
| Sudare | Bamboo screen; rattan blind. | | |

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1 | INTRODUCTION

1.1 | THE IMPORTANCE OF FURNITURE

Our lifestyles and cultural practices are reflected in our interior spaces, through the furniture that we use, giving hints of personality, date and location. The furniture doesn't carry its tradition and usage on its own. We are the ones who give furniture a meaning, a purpose and a place in our daily lives. Though, sometimes, we may be victims of our culture when we learn to use furniture in a way that ultimately degrades our living.

It may be beneficial to face furniture in a manner that gives us freedom to drastically alter its features, as to provide more satisfaction to the users. Therefore, when considering a design process, we could include re-evaluations of physical elements (color, form, material, structure) but also of immaterial features (lifestyle, usage, culture, value).

To have a broaden spectrum of choices, it may be useful to understand the multicultural origin and traditional use of furniture. For this, there is a need for comparative cultural oriented studies, to distinguish the different lifestyles from which certain furniture emerged. From this point on, we would need to identify the pressing issues that furniture places on our daily lives, such as lack of physical and psychological space, the overabundance of household cleaning tasks, etc.

It's important to evaluate the meaning of furniture in our lives and determine if there should be any changes to it as well as to our lifestyles. With comparisons to different cultures it's easier to identify problems in our own lifestyles that we couldn't previously diagnose. Since this thesis is being written in Portugal, the main type of home with which other foreign cultures will be compared to, is the Western home (by Western the author is including Western Europe and North America, the main sources of information available). The Oriental culture will be used as a comparison to the Western (by Oriental the author includes mostly Asian countries namely Japan, China and South Korea, noting that Japan will be the most present with the mention of the traditional Japanese home as a case study).

In the Western culture, the author was able to identify problems related to: uncontrolled consumerism, space vacancy, time handling, cleaning difficulties, room flexibility and spiritual connections with ourselves, life and with nature. The author was also able to predict solutions based on a better understanding of the problems, in the influences of the Japanese lifestyles, and in the innovative approaches in the trend of micro living. A general conclusion would be that emptier, flexible houses could have advantages that would greatly improve our lives. Therefore this thesis will focus on making a deeper consideration of the propositions presented, undergoing a deeper research phase, acquiring feedback from the users, and making final conclusions and recommendations to the product design field.

1 | INTRODUCTION

1.1 | THE IMPORTANCE OF FURNITURE

In addition to this thesis being dedicated to the poorest population living in extreme lack of space, this thesis is also aimed to the general population, assuming that there is one that wants to escape from the traditional use of furniture, and that this population prefers to be defining how they want to use furniture, instead of letting the industry decide for them. With this in mind, the result of the research in question will provide recommendations to space-saving furniture or home layouts, which could simultaneously be enjoyable for different cultures and lifestyles.

2 | TITLE

FIELD: Product Design

THEME: Smart Furniture for Smart Homes

TITLE: Saving space with furniture design

SUBTITLE: Focusing on worldwide micro living and the traditional Japanese home as case-studies

3 | PROBLEMATIZATION

3.1 | EXISTING PROBLEMS OF WESTERN HOMES

When taking a first look at our western homes and observing our daily routines, the most common inconveniences of our homes, how social inequality defines the type of home we live in, and what's missing in our homes (when compared to Oriental homes), it is possible to identify some of these problems:

- Lack of Space

The house has limited space for fun activities with family and friends. Our belongings and the furniture we use to store them, steals space that could otherwise be used for quality time with friends and family.

- Unflexible Rooms

Have you ever abstained from hosting your children's parties because you didn't have space? Have you refrained from having more children because you lacked space? Do you have space for hobbies or for stretching your body?

Sometimes growing families have to move when they have a new addition to their family. Poor families that can't move to a bigger place may have to refrain from doing activities that would require more space like having children's parties, or practicing sports or hobbies inside.

- Expensive Market

Overpopulation is already a problem in the biggest cities of the world. In the short term there won't be room for more buildings and this will make the existent houses increasingly expensive. Because prices are high in overpopulated places, big families can't afford to buy needed space. There have been new ideas surfacing about the construction of micro homes. These will sell for less money which will allow a greater number of young people to be able to buy property.

- Needs Abundant Cleaning

Overworked and tired population has trouble finding time to keep up with the cleaning and maintenance. We spend a lot of time cleaning our houses. This is mainly because we have a lot of furniture that needs dusting, and a floor, with lots of obstacles, that needs vacuuming. Abundant furniture equals abundant maintenance and cleaning. Also, cleaning becomes difficult when reaching tight spots. U.C.L.A researchers who observed thirty-two middle-class Los Angeles families, noted that all of the mothers had stress hormones spiking during the time they spent dealing with their belongings¹.

¹ Source: Arnold, J. (2012) Life at home in the twenty-first century. Cotsen Institute of Archaeology Press, Los Angeles.

3 | PROBLEMATIZATION

3.1 | EXISTING PROBLEMS OF WESTERN HOMES

- Lacks a Spiritual Refuge

There isn't a custom of having a relaxation/meditation place in the Western culture. The bedroom usually serves this purpose for five minutes before we fall asleep, but this may not be enough to relieve the mind and recharge the batteries.

"Home furniture is simply magical. It pays to invest a lot in home furniture as it has a way of livening up one's mood. If it's good, it could make a good day great, and if it's bad, it could make a bad day worse—31 year old African-American male in Maryland" (Ponder, 2013).

- Uncontrolled Consumerism

Additionally our planet is also suffering with our consumerism. We buy too many things, too many furniture and decorations in the course of our life. When someone moves or remodels a lot of furniture goes to waste. There is excessive consumption and production of furniture. U.C.L.A researchers also observed that 75% of the families couldn't park their cars in their garages because they were too jammed with things².

When asked about furniture possession in a Mississippi survey³, the responses were:

35% "I like to replace some of my furniture every few years."

18% "I change my furniture often to keep up with design trends."

95% "I expect my furniture to last for many years."

- Environmental Impact

From the extraction of resources, to manufacturing, to waste disposal, consumerism is pushing our planet to the brink. To be sustainable, it's best not to buy new furniture but to repair it. 63 million metric tons of wood is sent to landfills each year. 33% of the world's wood is used by U.S. consumers⁴. 403 tons of Carbon Emissions are saved if furniture is refinished, reupholstered and remanufactured⁵.

2 Source: Arnold, J. (2012) Life at home in the twenty-first century. Cotsen Institute of Archaeology Press, Los Angeles.

3 Source: Mississippi 2013 survey for Furniture Outreach Program in <http://www.ffi.msstate.edu/pdf/consumer_attitudes.pdf>- accessed 28.01.16

4 Source: <<http://www.officefurnitureexpoatlanta.com/blog/2013/april/the-upside-of-used-furniture-infographic-.aspx>>- accessed 28.01.16

5 Source: <http://therefinishingtouch.com/trt_infographic_082714.html>- accessed 28.01.16

3 | PROBLEMATIZATION

3.2 | RESEARCH QUESTIONS

Q.1 Is the current Western relationship with furniture, room usage and household chores balanced with our lifestyles and surroundings?

Q.2 If not, can furniture design intervene to aid with cases related to lack of space, unflexibility of rooms, overpopulation, economic difficulties, overcrowded homes or overabundance of household chores?

4 | HYPOTHESIS

The development of a furniture design solution which can be integrated in a standard home or in a micro home, with a focus on saving space, will be beneficial for overpopulated cities with lack of space to lodge newcomers, for big families with economical difficulties who can't afford a big enough home to have a comfortable life, and possibly every other kind of household.

5 | RESEARCH DESIGN

This project will use a mixed quantitative and qualitative methodology.

Initially a theme is chosen, and then a title and its research questions. To answer the research questions it is necessary to have a literature review with data collection, selection and analysis that results in a synthesis of the State of the Art. From this point on, there is enough information to develop a hypothesis for the solving of the research questions. This hypothesis will be backed with a non-interventionist research that will include Observation, analysis of Case Studies and Survey Inquiries, with a semi-structured methodology, to validate the user's opinion in relation to furniture's quantitative and qualitative value—closed questions would provide quantitative information like “how many times do you use this furniture”, “how much furniture do you have”, “how much money would you spend for a total redecoration of your house”, etc. Afterwards, the survey results will allow for interpretation as to which solutions are more recommended for each space-saving case.

The new knowledge produced in this updated hypothesis will be transferred to a final conclusion. This conclusion may or may not be contributing to the Investigating Area of Product Design. In the case that it is, final recommendations will be made to help with further investigation on this subject and possible investments on manufacturing.

5 | RESEARCH DESIGN

5.1 | ORGANOGRAM

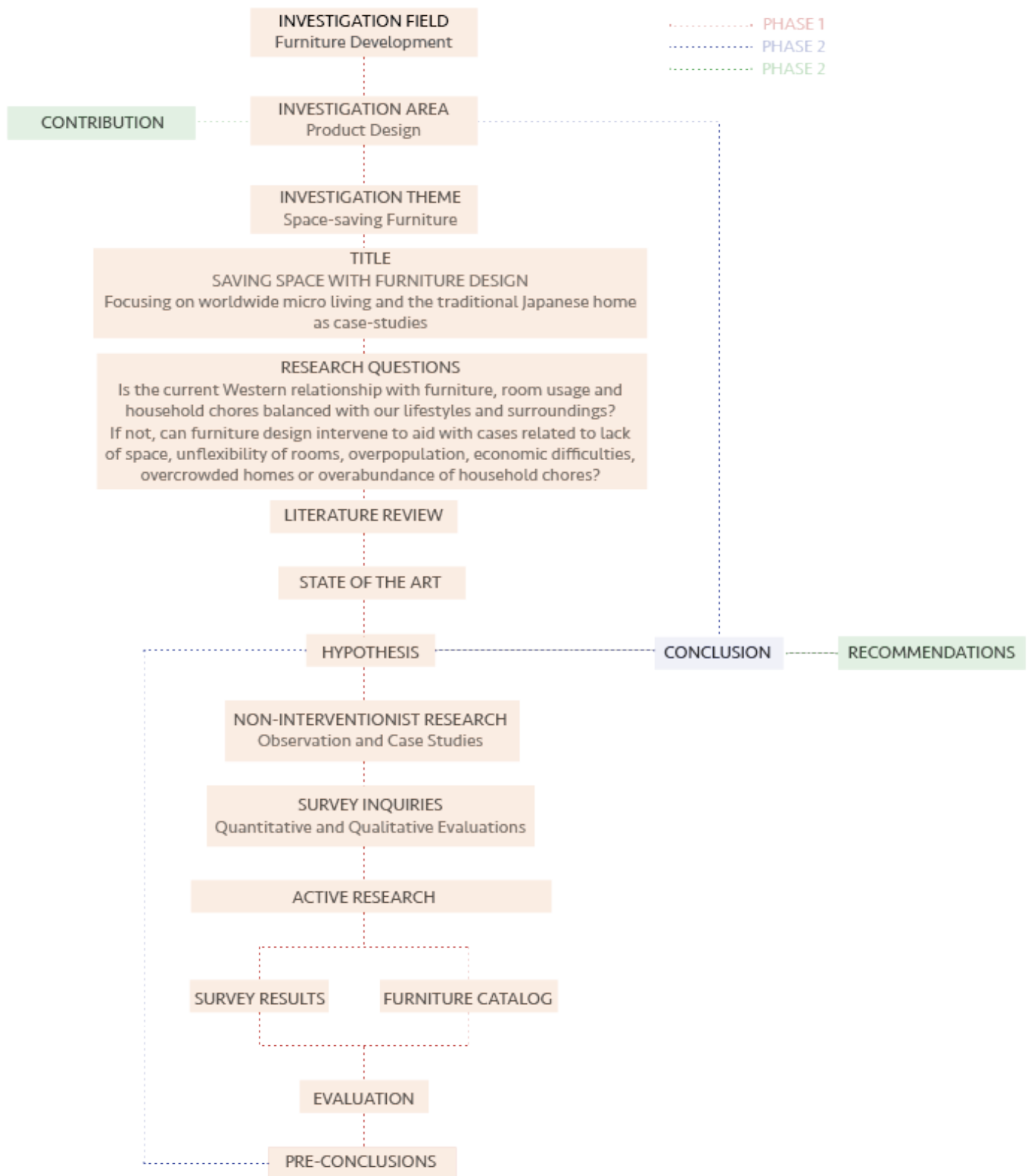


Fig.1 Organogram of the Research Design (Author, 2016)

6 | OBJECTIVES

6.1 | GENERAL OBJECTIVES

- Improve our relationship with our home by saving time, decreasing the amount of obstruction and maintenance and increasing the amount of enjoyable private and family time;
- Have an increase of space that would allow spending more time with family and friends;
- Provide a solution to having a comfortable, multi-functioning, small family home;
- Provide flexibility to a small or large house;
- Relieve the overtired population from household chores and need for space (by either using less furniture, combining functions in one piece of furniture, use foldable and storable furniture, adding an entrance-hall shoe-storage habit, or by using automated cleaning appliances like robot vacuums);
- Add a space for relaxation and rest. Don't depend on external services to have a peaceful time;
- Reduce global consumption of furniture, providing environmentally sustainable alternatives.
- Take into account the varied range of Western house constructions (including micro homes).

6 | OBJECTIVES

6.2 | SPECIFIC OBJECTIVES

- Use the Japanese traditional home, floor storage, micro homes, flexible walls and modular furniture as case studies. Start by comparing the Japanese and Western indoor lifestyles. Then explore the Western relationship with furniture and home living and identify the contradictions that trouble our daily-lives. Focus on the bareness of space and floor-sitting customs;
- Give flexibility to all the useful space by removing permanent walls and reducing the amount of furniture;
- Take advantage of the available space, and study the floor space needed per person;
- Provide solutions that can be accepted both in the Western and Eastern culture (don't assume that customs like floor-level living are restricted to Asia).
- Aim for a wide community, of low, medium and high economic classes. Have solutions targeted for normal sized homes and also really small houses such as those in overpopulated areas.
- Open up the entire house in one room for bigger events.
- Create divisions according to the needs or facilitate the constant shift of needs in a room (be able to invite more than one friend over and easily host dinners or parties).

7 | BENEFITS

The main benefit that the author aims to achieve with this research is targeted for society as a whole, with a special focus on the author's own society, the Western/Portuguese. There is a general stress environment in these developed countries and the subsequent tiresome house furnishings don't help with this situation. The benefits we intend societies to achieve with this research are those of:

Providing relaxation inside the home for the tired worker. No more trips to the spa for a peaceful time. *Living* time could be spent in the **comfort** of the house and the company of friends and family;

Reducing the household chores. Abundant furniture equals abundant maintenance and cleaning. The removal of protruding furniture can become very beneficial for the cleaning processes. The introduction of a *genkan* space is also very helpful for keeping the shoe's dirtiness in the entrance;

New opening for the robotic cleaning appliances market. The implementation of automatic cleaning robots is also easier due to the linear surfaces. Good for the markets and good for the people.

Facilitating the constant shift of needs and occupancy of the rooms. With crescent economic difficulties, home apartments tend to become smaller. There is no reason to limit comfort to the wealthy classes. Small homes can become comfortable if integrated with flexible systems that can turn the bedroom into a living-room. The arrival of a new member to the family doesn't need to have an added stressful difficulty of space. Instead of moving to a bigger home, there is a possibility to **create rooms when needed**;

Encourage a deeper relationship with nature, oneself, family and friends. In the occasions where a garden can be integrated in the home, it will provide an added satisfaction and close the almost non-existent relationship we may have with nature. The lack of furniture and the subsequent lack of chores could provide time for reflection and entertainment. It could also become possible to easily host large dinners or parties because of the flexibility of the walls. If, before, we restrained from inviting more than one friend because there was no space, now we wouldn't.

Improving human health. It would increase attention to the floor-living lifestyle and strengthen health analysis. Up to now there are only a few studies. One study claims that

7 | BENEFITS

“a smooth transition between floorliving and standing is a key to health and mobility” (Sisson, 2013). Another, is in the book, “Muscles and Meridians”, and it proposes that we can reduce the incidence of musculoskeletal distress by taking three steps:

“We need to spend more time on the floor - in the natural postures of sitting, squatting, kneeling; We need to be good at standing erect from the floor - this is a basic skill requiring a host of muscles to coordinate in work together; Our feet need functional rehabilitation - shoes are sensory deprivation chambers!” (Beach, 2010)

Be more environmentally sustainable. The reduction of furniture consumption would eventually reduce furniture manufacture and also furniture waste. Also, the propagation of gardens or vertical forests would likewise be very benign for the atmosphere. Considering the harmful environments we have forced nature to endure, this research could be very beneficial for the Planet in the long-run.

Benefits for the knowledge. The collection and analysis of many of this research’s information was accomplished with exhaustive searching. It is very difficult to find complete packed information on these subjects. This research could serve as a helpful compilation of space-saving furniture. It could also bring to light aspects of the impact and importance of furniture in our lives.

8 | DISSEMINATION

This dissertation will be disseminated in the internet and social platforms. The catalog of space-saving furniture will be shared in the format of pictures in social platforms like Pinterest. The results of the surveys will be shared among a few design companies who were interested in the results. An infographic of the results of the surveys may also be disseminated in social platforms.

9 | CRITICAL FACTORS OF SUCCESS

The ability to gather enough information on these rare matters is the most critical factor of success. Currently the author has been able to find plenty of literature, although it was difficult, and for that reason she still has to measure the amount of useful information available. Using sources such as libraries and Online search engines is essential. These are a few of the search engines valuable for acquiring scientific publishings:

<http://presans.com/resources/x-search/>

<http://www.repository.utl.pt/>

<http://www.sciencedirect.com/>

When it comes to researching the case study of the traditional Japanese home, it will be necessary to consult multiple sources to gather bits of information here and there.

“Surprisingly little is definitely known about Japanese furnitures since so much of the information on this subject has been passed down by word of mouth, through legend, or in the few texts available only in Japanese. While the discovery of available examples of antique Japanese furniture can be enjoyable and exciting, research on any given piece is often a challenge in modern-day Japan, where the traditional craft of making wooden furniture has continued with but a handful of established craftsmen.” (Clarke, 1983:1)

Making a good analysis of the value of furniture is also a difficult but important task. The author will make inquiries to help syntonize with a broader feedback, but ultimately in the active research phase, the author will have to come to conclusions about the future of space-saving furniture.

10 | FIELDS OF STUDY

For a better understanding of the relationships between the fields of study of this research the author designed the following diagram:

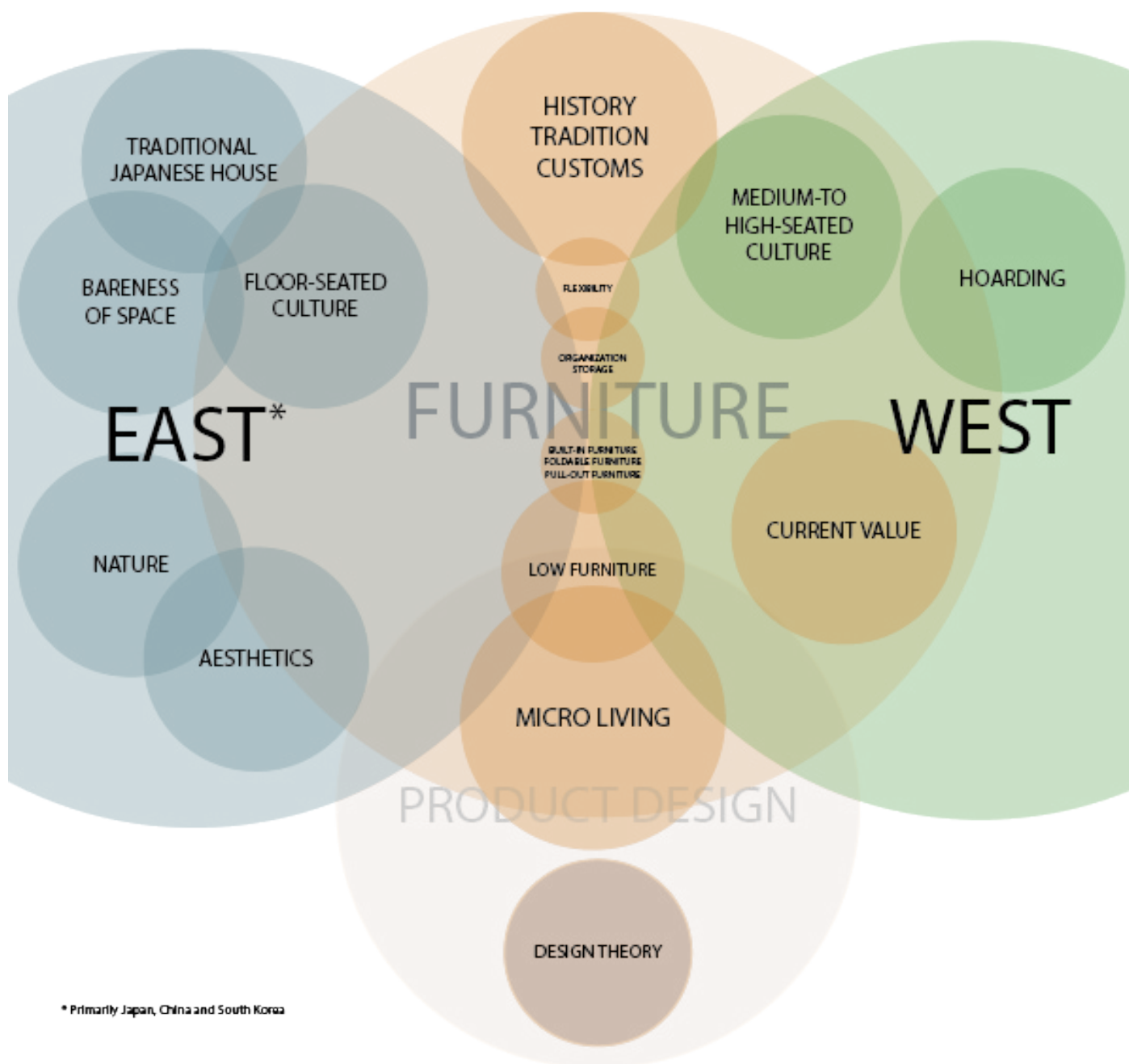


Fig.2 Fields of Study Diagram (Author, 2016)

11 | HISTORICAL CONTEXT

11.1 | BRIEF FURNITURE ORIGINS

11.1 | BRIEF FURNITURE ORIGINS⁶

Before furniture appeared, the primitive people lived nomad lives in constant fear. They were always moving and so it was troublesome to invent furniture that would require carrying. The earliest purpose of furniture served to glorify the tribe's leader, when his daring attitude and will to face danger allowed for the tribe to remain in one place for long. He was named king and given a seat to occupy a central position while surrounded by his tribe. The seat was given important value, and often assigned the king's role to whoever came into its possession. As the community grew, it became more complex to lead and soon the king required advisers. These advisers were also given seats (shabbier than the throne) and together with the king, they represented the most powerful people.

With time, tables were developed to assist with the leadership responsibilities as they provided space for things to be spread out. Either King Arthur's round table or our modern round-table conferences, or high tables at universities today, exemplify the significance and importance that the table came to acquire.

Thus, the first function of furniture was public. Thrones, chairs and tables were built for kings and people that performed public duties. They were intended to be impressive as they represented the most prestigious people in a society. It wasn't until families and private groups were formed in the tribes, that private furniture came into existence.

Wherever hierarchies were created, furniture had the possibility to help discriminate its classes. There are images from ancient Egypt and Greece that show the upper classes sitting in chairs and lying in bed while the slaves kneeled on the ground.

As for beds, they were common among the Romans and Greeks. Although in medieval Europe only the lords of the castles had beds, in the 1500s in England, daily lives were more established and the need and interest for physical comfort originated grand-sized beds. There was the Great Bed of Ware in 1580 that measured over 326 centimeters wide, and once fitted six citizens of London and their wives.



Fig.3 The Great Bed of Ware⁷

⁶ This topic's information source is: Reeves, David (1959) *FURNITURE an Explanatory History*. Faber and Faber, London, pp. 21-25.

⁷ Source: Victoria and Albert Museum in <<http://www.vam.ac.uk/content/articles/t/the-great-bed-of-ware/>>- accessed 31.12.14

11 | HISTORICAL CONTEXT

11.2 | WESTERN USE OF FURNITURE

11.1 | WESTERN USE OF FURNITURE⁸

The Western values put on furniture differ from other cultures, as do the lifestyles that unveiled them. For instance, wasting time to search for an object is unacceptable in the West. One mustn't be aware of the need for an object, as the object should be ready-to-use and always available—drawing almost no attention to the fact that there is a need. Objects must be out in the open and always ready to hand when needed. Storing those objects is considered to be time consuming and straining to the brain that has to memorize its location. Because objects tend to stay in the same place, walking around the house and avoiding to bump into a table becomes a habit. There's almost no need to think or visually confirm where a chair is, because blindly one sits where it's usually placed. Each room of the house has a different purpose, either private or not, and fits a different time of the day. There's a place for sleeping, a place for eating, and switching tasks between rooms is believed to be disrupting. "It is embarrassing to undress in a room that is arranged for eating: it violates the character of the room, and also makes the act of undressing a disorderly one" (Reeves, 1959:26).

Because daily habits are esteemed, any object placed in the home has to serve an obligation to encourage good habits. These good habits can be both saving energy and time and being efficient with the use. Therefore, objects that trigger bad habits, like possessive habits, also trigger unhealthy reactions like hoarding difficulties.

The Victorian times are an example of these misconducts. People only cared about possessing furniture, which—combined with the growing machine productivity—developed hoarding problems that inspired a culture that ignored the beauty of a balanced room, and the good quality and good service of a useful, easy space. Because they were so focused on demonstrating their prosperity—through the amount of furniture present in a room—it became impossible to walk through a room without tripping in something. Round 1910, after fifty years of steady acquisition, it was noted that homes had too much furniture. People developed a need to reduce their furniture by emptying their homes. Interior designers concerned with integrating furniture in simple schemes and little decorations—to present a barer room—started this new vogue. By removing fussy objects and patterned wallpapers and color combining the furniture with the walls, they succeeded in making jam-packed rooms unpopular. When the decorators eventually started designing furniture, they maintained the antique oak furniture style but opted for a non-decorative treatment. "A room which had been 'decorated' was nearly free of all decorations" (Reeves, 1959:172).

⁸ This topic's information source is: Reeves, David (1959) *FURNITURE an Explanatory History*. Faber and Faber, London, pp. 26-184.

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11.2 | WESTERN USE OF FURNITURE

Now, people try to have less furniture and search for minimalistic designs that merge their furniture to the house structure. Although Reeves states that “(...) in rooms furnished with the blank kind of furniture there seems no demand on the people in it for anything interesting to do with themselves” (1959:184), it is also possible that furniture itself shouldn’t be the focus of our lives. The interesting thing about life may not be what we can do with furniture; but what we can do with ourselves in a deeper emotional level. While furniture can aid in comfort for other activities, we may be too dependent on it to enjoy ourselves. Thus the focus on furniture maybe should be placed on its functionality, portability and flexibility to adapt to the different interesting things we can do with or without it.

Although there is a demand for simplistic minimal furniture, Reeves for instance doesn’t consider this furniture even to be real furniture. He values furniture that stands out and requires care. He considers wood to be a good material, rather than marble, glass, steel or wood substitutes, because even though it scratches, it imposes a demand to be taken care of. It also shows a history of use that he believes to improve its appearance, because furniture that has unbreakable, resistant materials—that don’t change over the years—are almost inhumane, in his opinion, in a way that we can’t relate and empathize with it.

Even so, neutral furniture is highly valued for work environments because it doesn’t channel any feelings, which enables the worker to focus on the monotonous non-personal work assignments. Office furniture efficiently tries to get more work out of the workers, keeping them for more hours instead of helping them get home earlier. Also, many people live in a hurry to be done with living almost effortlessly. These circumstances often require characterless, efficiency-optimized furniture with no interest in appealing to the person’s personal and private interests. This furniture is consequently very minimalistic, simple and functional—it doesn’t want to distract its users with details—and for this reason it can also be viewed as very personal furniture, one that values space, simplicity and focuses on the core of nature and life, while trying to connect our emotions with the purity of the furniture.

The problem with modern life furniture, according to Reeves, resides in the focus put on trade and industry and the poor attention put on the indoor house life. Mass production was originally a way to produce things cheap in big numbers, which the poorer people could afford. This way, the comfortable living conditions of all classes could be raised. But the disadvantage was that objects were all the same and the workers had repetitive

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11.2 | WESTERN USE OF FURNITURE

non-stimulating jobs. Therefore, these objects did provide comfort but were unsatisfying both to the population and the workers due to its lack of aura and personality. It was like obtaining fake cloned furniture that provided comfort but missed the soul. The Arts and Crafts Movement intended to solve this exact problem. Initiated in England during the latter half of the 19th century, the Arts and Crafts movement was inspired by the social reform concerns of Water Crane, John Ruskin, and William Morris. Their ideals opposed the brutal condition of the factory-working environment. With help from the rising of the consumer class, they proposed individual craftsmanship that provided good conditions for the workers, and at the same time, new and different objects for society. In this period, manufacturing had poor design and quality. The revival of individual craftsmanship could be the salvation for the workers and the population. Objects could be “for the people and by the people, and a source of pleasure to the maker and the user” (Reeves, 1959).

Even so, standardized furniture can be useful, if well made, because too much variety, in the daily use, can cause confusion. “People resemble one another in many ways and it is natural that there should be some uniformity in their possessions” (Reeves, 1959:169).

As a side note, if we think of IKEA’s approach to design, we can identify satisfaction both in users that have a large variety of furniture with creative usage at their disposal, and to the designers as well for having the freedom to be creative and interact with intimate features of the people’s lives. Still, as long as building and equipping a factory remains expensive, its profit will target the needs of the people as well as their possessive habits. Therefore, there are being produced many objects that respond to no need—but try to create them, sometimes successfully or not—and consequently putting pressure on people to buy the cheapest most irrelevant beautiful object. Learning to cope with these stimuli can be hard especially for those that are already overwhelmed with work and family responsibilities. The unscrupulous control that the consumerist industry holds on society is debilitating to both the poor classes as well as the highest economic classes. For the poorest classes the material possessions may become the anxious course to happiness and to the highest classes the possessions may fill people’s lives with material objects that give no space for slowing down the daily speed and have some peace. Ultimately, the home is maybe rarely a place to relax the spirit and contemplate life, nature and the universe.

“So it is, more and more, that people feel they have reached the height of modern happiness when they have spent their money and got their purchases home and are in possession of the benefits of civilization like everyone else. There seems nothing

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11.2 | WESTERN USE OF FURNITURE

else left to do, except enjoy themselves—which generally means going to the cinema and seeing the troubles of other people smoothed out. Of course they have worries of their own; but because the mass-production system has trained them to believe that happiness is in the possession of things such as everyone else has, all their troubles are money troubles. And so very few people get to the point of living lives of their own, thinking thoughts of their own, finding happiness in their relations with their friends. The old, restricting family privacy has gone; but the uniformity of the materials of life today has a deadening effect on personal contact, so that there is even less intimacy between people than formerly” (Reeves, 1959:170-171).

11.3 | JAPAN AS A CASE STUDY

Many of the Japanese home lifestyle traditions emerged in the earliest Japanese history, yet there was a profound housing design leap in the 14th century, which lingered for the next 600 years and still retains influence in Japan. This leap not only valued the merging of nature in a house’s interior, but also the spaciousness in small spaces. By dismissing the inessential and focusing on the beauty of fragile, temporary, unembellished, humble materials that emphasized a feeling of eternity, it provided a quiet, still space from which the soul could deal with the world. These ideals were professed by influential Zen Buddhist priests in the *Muromachi* and *Momoyama* periods, and were highly followed by the entire Japanese society. While European and English homes were being stuffed with rare objects from their established colonies, the Zen Japanese ideals were encouraging the sweeping of decorations and furniture, turning the home into a clear space that provided flexibility. According to the needs of the hour, beds would be laid down in the night, and stored in the day to provide space for meals, entertainment, work and other activities (Tada and Mehta, 2005:9).

Japan has been attracting the attention of Westerners for long, since it gradually termed its isolation from the world, around the end of the 19th century. The centuries-old social

Table 1. Japanese Eras (Author, 2016)

| PREHISTORIC | |
|-----------------------------|--------------------------------|
| Jōmon | ca. 10.000 B.C. - ca. B.C. 300 |
| Yayoi | ca. 300 B.C. - ca. A.D. 300 |
| Kofun | ca. 300-710 |
| ANCIENT | |
| Nara | 710-94 |
| Heian | 794-1185 |
| MIDDLE AGES (MEDIEVAL) | |
| Kamakura | 1185-1333 |
| Northern and Southern Court | 1333-92 |
| Muromachi | 1392-1482 |
| Warring States | 1482-1573 |
| PREMODERN | |
| Momoyama | 1573-1600 |
| Edo | 1600-1868 |
| EARLY MODERN | |
| Meiji | 1868-1912 |
| Taishō | 1912-26 |
| Shōwa | 1926-89 |
| Akihito | 1989-present |

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11.3 | JAPAN AS A CASE STUDY

structure and traditional culture that had managed to remain stable for so long came under enormous pressure after World War II, with the advent of rapid industrialization and the entrance to the World Market. But when the traditional ways of life started to fade, a fresh generation of Japanese architects deliberately tried to integrate meditation and self-retreat to the Japanese life, producing impressive examples of contemporary interior design (Bürdek, 2005:209-212). These, and other efforts to maintain a place for the soul in the home, instead of facing it like a machine to live in—as would *Le Corbusier*—has assisted in the perseverance of the traditional Japanese ways of life and its international appreciation to this day. In this analysis the author is going to explore the traditional indoor culture of Japan, while contrasting it with Western ideals. The focus will be primarily placed on the flexibility of spaces, the floor-level lifestyle, the bareness of the rooms, and the alternative types of furniture that can compliment all of the before.

11.4 | THE APPEAL OF JAPANESE IDEALS

The first aspect that comes to mind when comparing Japanese customs to the West is the emptiness of the Japanese rooms. This is probably the most contrasting element between these two cultures. The lack of space and the abundance of furniture versus the bareness of space and the reduction of furniture. As a fully-grown Western individual the author is bothered by the relevance of a full-furnished room. Yes, it's useful to have a desk when we need to write something down, and to have as many cabinets as we need to store all of our belongings, but ultimately this furniture can never fully satisfy for long. Over time, while we are filling the desk with a computer, piles of books, framed photographs, pencil cases and even teacups, the desk becomes more and more useless. The main interest that was in the providing of space was surpassed by the need to place our growing collection of property in someplace free. It's frustrating that no matter how many cabinets and boxes we buy, the amount of things that we keep acquiring continues to grow, and in the meantime there is no more room in the house to buy new furniture. Surely we may end up packing every compartment or surface until it becomes dangerous to come close to the pile of books because if touched, they might fall. We became a victim of our own consumerism and a victim of the status that we granted to the furniture. Because we learned that furniture was the solution to every organizational problem in the house, we acquired so much furniture that we're not the one comfortable in our house, our furniture is.

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11.4 | THE APPEAL OF JAPANESE IDEALS

When looking at the minimal, almost empty Japanese traditional rooms the author gets an urge to pack her bags and move to Japan. Why is it that we have to live with the responsibility of cleaning, maintaining and using furniture? Isn't it enough that we have to spend all day working for a living, that when we come home we still have to deal with prolonged cleaning duties? If the Western accumulation of furniture had the purpose of saving time by providing permanent spaces to do every sort of task, how are we saving time when it hinders the cleaning of the floors and creates even more corners and surfaces to wipe? Could the Japanese way be a better approach in terms of cleaning, availability of space and peace of mind?

There must be a way to free ourselves from this big-sized equipment and find comfort in some other way that doesn't end in: us feeling overwhelmed. Alas, the author is one of the Westerners captivated by the possibility of having a relaxed, contemplating experience in her own house. The more she reflects about the state that we reached the more unbelievable this whole situation looks like. How is it that we haven't identified these problems and tried to solve them yet? Is it because of the manipulative force that the industry has on our notion of happiness being defined by material possessions?

11.5 | JAPANESE FURNITURE INTRODUCTION⁹

It was around the *Kofun* period (ca. 300-710) that furniture appeared in Japan, when members of the imperial *Yamato* clan began living in raised-floor dwellings. Before this, even the upper classes were living in pit dwellings where the only furniture they had were "straw mats (*mushiro*) used as floor coverings and door flaps, primitive pitch-pine lamps, oil lamps, baskets, and lacquer ware with a basket core" (Koizumi, 1986:151). Still after this, the general population of Japan continued living in pit dwellings until the Middle Ages (1185-1573), so the first furniture tradition, that began with the move to raised-floor dwellings, took a long time to reach the entire population. As this first furniture was built for the upper classes, likewise was the subsequent development of chairs—very limited and reserved exclusively for the emperor, empress, crown prince and certain ministers.

There's a difficulty with identifying traditional Japanese furnishings because on one hand there was never many furniture in Japan, like there was in the West, and on the other, the term *kagu*—that literally means house makings—has a very limited historic use. Its meaning changed in nearly every period and with each change a piece of furniture stopped or started to be considered furniture. This happened to a lot of objects such as: trays (*bon*), common

⁹ This topic's information source is: Koizumi, Kazuko (1986) *Traditional Japanese Furniture*. Kodansha International Ltd., Tokyo.

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in the *Meiji* era, they were used as individual settings for meals but since the adoption of the Western dining table they have since ceased to be regarded as *kagu*; *tatami* floor mats that in ancient and medieval Japan covered all of a house's floor, were replaced by built-in flooring and thus removed from the modern notion of *kagu*; and doorway curtains (*noren*) were also once an important type of partition but have now fallen to disuse.

Another important characteristic that should come to context is that the Japanese have traditionally lived at floor level. Even though most cultures evolved from floor-level lifestyles, the Japanese retained this custom. Despite having come in contact with the chair-seating lifestyles—brought by foreigners many times over the centuries—the Japanese chose to remain at floor-level until the end of World War II, and this practice greatly shaped the traditional Japanese furniture. Because of this floor-level lifestyle there was no need to incorporate legs into furniture to raise it for seating or reclining. Thus, everything stayed low and easy to reach from a floor seated position. Then, because furniture stayed low, and the people were seated when interacting with it, the furniture had mainly one frontal perspective when looking at it. Thus only frontal designs were taken into account. The sides and back of the furniture had little to no concern.

Shitsurai is an important notion—dating back to the mid-*Heian* period—that shaped furniture to fit a standard architectural frame from the floor up. This style was defined by bareness of the interiors and comprised a structure with almost only wood floors and columns. From this structure there were developed partitions to divide areas, in the shape of doorway curtains (*noren*) and folding screens (*byōbu*). *Tatami* mats would also cover the floors and a low table or free-standing shelf would be placed in the room to provide functionality. *Shitsurai* thus symbolized the ability to give different purposes to a room by arranging articles. This provided versatility to the rooms of the (aristocratic) *shinden*-styled villas, when before, rooms didn't have a special purpose—like dining or sleeping chambers. Eventually the *shinden*-style developed into the *shoin*-style, with fully partitioned rooms and continued to evolve up to modern times, while preserving the practice of *shitsurai* through every style. But still in modern times, the partitions were nothing like Western or Chinese walls. These *shitsurai* traditional, “set in place” products consisted in removable sliding door panels (*fusuma*), translucent *washi* paper panels (*shoji*), and a whole lot of similar independent partitions. There was also a tendency to convert portable furniture into built-in furniture thus losing their occasional appearance in the room. “Free-standing shelves soon came to be built in place, while cabinets for bedding were tucked away in the walls as *oshiire* (literally ‘push-in’ bedding closets)” (Koizumi, 1986:11).

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The systematization of standardized dimensions and stackable furniture was characteristic of the Japanese traditional furniture although it was only accomplished in the West from the start of industrialization. Standard dimensions were common between interchangeable modular furnishings, such as *tatami*, *fusuma* and *shoji* panels that still have today the same 90 x 180 centimeters. *Tansu* as well, (storage cabinetry) can be modular and stackable, chest-on-chest, and broken down to carry by attached handles. Even tray-tables were able to be stacked to impressive heights—this ability was extremely used in restaurants and traditional inns.

The linearity of the Japanese furniture can resemble very box-like forms. *Tansu* and tables have very simple block like forms—except for the ceremonial tables that exhibit more fluidity. Similar to the architecture, there are little curves or decoration, like in the voluptuous Western compositions. Instead of having interest in the complexity of the forms, the Japanese focused on surface treatment techniques. There are two types of applications for wood: “a cosmetic application of lacquer or decorative *maki-e* lacquer designs, typically in delicate, lyrical pictorial representations or symbols from nature; another is the rendering of the wood itself into the object of esthetic appreciation” (Koizumi, 1986:12). The last one is applied to light colored woods—such as cypress, cryptomeria, pine, paulownia and magnolia—and intends either to accentuate the natural raw beauty of unfinished wood (*shiraki*) or to emphasize the alluring wood-grain effect (*moku-me*).

“Of the two, the eye attuned to plain, unfinished *shiraki* seems a uniquely Japanese sensibility. Elsewhere in the world, the taste for wood grain runs strong: in the West, from Gothic to English country furniture, and particularly in Baroque and Rococo furniture parquetry; in the Orient, Chinese and Korean *Yi* dynasty chests are exemplary. Yet probably no other culture exhibits such fondness for fresh, clean, planed wood surfaces. Very recently, some furniture coming out of Scandinavia in particular, has begun to feature plain pine for its esthetic value, but this is largely due to a Japanese influence on the vocabulary of Modernism” (Koizumi, 1986:13).

Simplicity is another important feature, as there appeared to be no desire to produce complicated combinations from different materials. Contrary to the European furniture that mixed wood, leather, metal and even stone, the Japanese preferred not to go further than a simple wood with metal fittings combination. Lastly there is a general inclination for asymmetry—that can be explored in the esthetic values of *wabi-sabi* among others—which basically takes pleasure from a balanced inconsistency. This propensity extended

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to the gardens, the architecture, the plastic and decorative arts and was opposite to the broad appreciation of symmetry in the West.

In much the same way that furniture can be destined for different social classes, in Japan, furniture can also have different formal uses. The formality is defined by its symmetry: “(...) the most formal designs display an exacting symmetry, while semi-formal and informal styles are progressively freer in conception” (Koizumi, 1986:12). When attempting to create an asymmetric form, one should stop at an almost balanced point. The key for a genius design is the sensibility to find that point. This categorization of formality is present in other areas such as in calligraphy where there are formal, semi-formal and cursive scripts (*shin*, *gyo* and *so*).

5.2.6 | A FLOOR-SEATED CULTURE¹⁰

“If people know anything at all about Japan, they know that the Japanese sit on the floor” (Koizumi Kazuko, 1986:149).

The Japanese custom of sitting on the floor has shaped the world of Japanese furniture to a great extent, while surviving through many years of foreign exposure to seating-lifestyles. This firm habit arouses an interest to explore its history and persistence.

The earliest record of the arrival of the chair to Japan took place in the late *Kofun* period (ca. 300-552). After its continental introduction, it was used among the members of the ruling class that were concerned with having a Chinese lifestyle. However, the subsequent *Heian* period (794-1185) enclosed Japan to isolation that ultimately made the chair disappear. The second contact with chairs came with the Sung-dynasty *Ch'an* (Zen) Buddhism, in the *Kamakura* period (1185-1333). This time it was the upper-class samurai that enjoyed sitting in chairs, when coming to Zen temples, in imitation of the head priests. Again, the chair lost its interest, after the common people didn't adopt it. The third time came in the *Momoyama* period (1573-1600) with the Spanish and Portuguese missionaries and traders. The chair was placed again in the use of upper-class samurai—and also of wealthy merchants and entertainers—only to die out once more. And it wasn't until the *Meiji* era (1868-1912), after the chair was reintroduced from the West, that the practice finally caught on in Japan.

Approaching this question in an anthropological way, there are three main reasons behind

¹⁰ This topic's information source is: Koizumi, Kazuko (1986) *Traditional Japanese Furniture*. Kodansha International Ltd., Tokyo.

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11.6 | A FLOOR-SEATED CULTURE

the historic global change from floor-sitting to chair-sitting lifestyles. The first reason derived from the desire to avoid the dampness and chill of the ground. This reason didn't affect the Japanese culture because from the very first architectural structures—that were introduced by the Asian continent around the 3rd to 2nd centuries B.C.—the floor was elevated to provide a barrier from moisture, in grain storehouses and ruling clans' living quarters.

The second reason had the purpose of distinguishing the ruling class from other people, and the third reason—purely coincidental because it depended on historical, political or geographic circumstances—was foreign domination or influence. In the European example, the chair was born in Egypt, and then passed through Mesopotamia and influenced Greece, and consequently Rome, when Greece was dominated. Afterwards came the Byzantine civilization that was able to spread the tradition all over Europe. As for Japan, this factor is more complicated and left to speculation. One possible reason for the lack of chair influence could be Japan's purposeful isolation from the outside world as well as its position as an island in the Far East. Also, during the times that the chair came to Japan, it was always regarded as a curious object. People had no real connection to whoever integrated the chair in their style of living. Apart from this, the Japanese have historically preserved strong traditional values and remained conservatory with many aspects that had only minor changes since the *Kofun* period (ca. 300-710) to the present day.

It was actually only after World War II and the improvement in the means of transportation and communication with the outside world, that Japan finally adopted the Western furniture, and with it, a chair leveled lifestyle. Combined with the desire to forget about the past national defeat, the growing economic ability of the population and the new industrialized mass production that lowered prices, helped to establish a new cultural goal that was the comfortable American lifestyle (it came with the living-room, the kitchen and the children's room furnishings such as chairs, tables and beds).

“Thus, according to a 1983 nationwide survey conducted by the Japanese Government Economic Planning Agency, 65.1% of all households (farming house-holds included) had dining-room sets (dining table and chairs), 47.7% had Western-style beds, and 40.5% had sitting-room sets (sofa, armchairs, and coffee table).

Nonetheless, the majority of Japanese hold a special place in their hearts for *tatami*-floored rooms and traditional furnishings. Even today, apartments and houses

11 | HISTORICAL CONTEXT

11.6 | A FLOOR-SEATED CULTURE

will generally have one Japanese-style room. In fact, many busy urbanites find the simplicity of a room with *tatami* and *tansu* a refreshing and soothing change of pace from their all-too-western surroundings, and dream of someday retire to a Japanese-style villa. And it should be noted that they are probably not alone, for furnishings and other accoutrements of Japanese living are now cherished abroad as among the finest in the world, providing a welcome touch to homes everywhere" (Koizumi, 1986:177).

12 | THE TRADITIONAL JAPANESE HOUSE

The traditional Japanese living room has little furniture, *tatami* mats covering the floor, and preferably a view to the garden. While a Western room has clearly defined functions (either for dining, living or sleeping), in the traditional Japanese house, one room can act as several Western rooms by being able to have several functions, each of them determining the size of the room at the time (Yagi, 1982).

This was possible because the Japanese architecture focuses the support of the roof on pillars and not on solid permanent walls, in comparison to the West. Thus, there was an opportunity to develop movable partitioning such as sliding doors and folding screens that made the rooms easily changeable, by joining and separating spaces. It became very useful to totally remove all partitioning and create a large room when accommodating a large number of guests, as well as creating small rooms for a guest's unexpected private need. This attribute was also convenient for adapting to the season's climate. When in Summer—with hot temperatures—the house could have a soft breeze if partitions were removed. And in the freezing Winter, by creating small divisions the heating produced could be trapped and preserved for an energy efficient consumption (Yagi, 1982).

The custom of floor sitting was one reason for the reduced amount of furniture in a traditional Japanese house. The *tatami* mats served as a kind of chair, table and bed at the same time, and the few storing furniture that existed was fitted in a wall closet. It was common to store articles away after using them, returning the availability of the space for other functions. So the *futon* mattresses, pillows and blankets were brought out and laid in the *tatami* floors at night, and stored in the morning. Afterwards a low table and floor cushions would be placed in the room for the family meal and then cleared to let the family convene for the rest of the night and perform other activities such as watching television (Yagi, 1982).

Today, Japanese houses combine Japanese and Western-styled rooms. There is at least one Japanese styled-room in a number of houses. These are pared to a minimum, complemented with *tatami* mats and can be used as a drawing room, a guest room, or simply a place of retreat. "For many Japanese, a simple, uncluttered *tatami* room does-wonders for the soul" (Yagi, 1982:43).

"Understanding the traditional blueprint will help you think about the aspects of the Japanese lifestyle that you might wish to adapt, such as removing shoes and storing them in a cabinet in the foyer, sleeping on a *futon* close to the mild aroma of *tatami* mats of a woven straw, or relaxing in a deep soaking tub up to your shoulders

12 | THE TRADITIONAL JAPANESE HOUSE

12.1 | STRUCTURE

with a view of a garden at the end of a busy day. It will also help you to think about floor plans differently. You might opt to omit one or more permanent walls in favor of sliding partitions or expand the view of the garden through larger windows or openings” (Gong and Parramore, 2009).

12.1|STRUCTURE¹¹

The Japanese housing construction consists of an outer wood frame and a covering roof. Inner walls aren't part of the structure as a result of the need for cross ventilation during the hot and humid seasons. Unlike the Western building method that consists on first building every separating wall and in last place the roof, the Japanese leave the inner walls for last. These walls don't even have to enclose the house, they can be supporting posts or movable partitions, in the way that they can open the interior space and join it to the exterior. Nature is in fact the ultimate goal of Japanese architecture, and as a result, the Japanese house can be divided in three spaces: exterior, intermediate and interior. The exterior representing the garden; the interior representing the space in which to spend most of the time; and lastly the intermediate space serves as a bridge between them, as it tries to bring nature closer to the interior while still providing protection and security from the exterior.

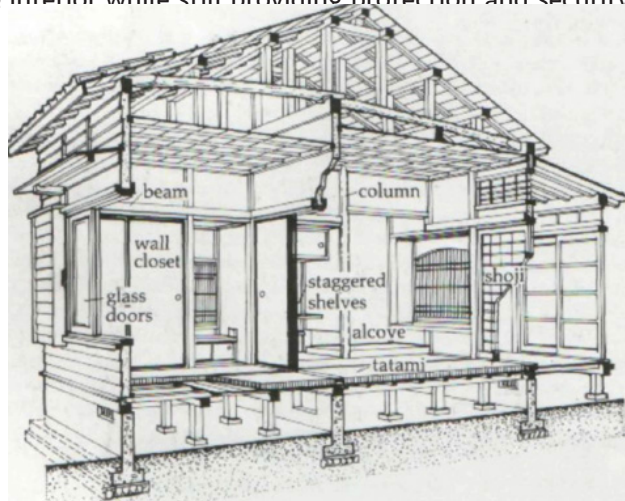


Fig.4 Section of a Japanese house (Yagi,1982)

12.2|GENKAN¹²

The Japanese home, in addition to being divided in interior and exterior spaces, has an intermediate space occupied by an entranceway, a veranda and multiple screenings. In this way, the Japanese home is a shelter while at the same time keeping contact with the

¹¹ This topic's information source is: Yagi, Koji (1982) A Japanese Touch For Your Home. Kodansha International Ltd., Tokyo.

¹² This topic's information source is:

Gong, C. and Parramore, L. (2009) JAPAN HOME Inspirational Design Ideas. Tuttle Publishing, Singapore.;

Yagi, Koji (1982) A Japanese Touch For Your Home. Kodansha International Ltd., Tokyo.

12 | THE TRADITIONAL JAPANESE HOUSE

12.2 | GENKAN

nature outside.

This division between inside and outside is demarked by behavior: leaving the shoes in the entrance way is how we enter the privacy of the home. The physical division is made from a ground-level entry where the shoes are removed, that may use stone—*kutsunigi ishi* is a shoe removal stone placed in a *genkan* or next to an *engawa* (veranda)—instead of wood floors (there are other fairly similar layouts). It marks the boundary between the unclean outside and the intimate clean of the inside.

The furniture in the *genkan* or entranceway comes with not much more than a cushion or a chair (for people to sit while taking their shoes off) and a cabinet where family members and visitors who are staying overnight can leave their shoes. The storage can be a sliding built-in compartment in the wide step that symbolizes the beginning of the interior space. If the stay won't be prolonged, the shoes may not be stored but only placed facing outwards for an easy slip when leaving. Also easy to slip on, when going to the garden, are special wooden sandals called *geta*.

The decoration is minimal and it is common to be able to see the garden from the entranceway. Since this room is also used for conducting business, there is usually a wall, a screen or a curtain separating it from the rest of the house, allowing the family life to proceed as normal during these visits.



Fig.5 Genkan (Gong and Parramore, 2009)



Fig.6 Genkan (Gong and Parramore, 2009)

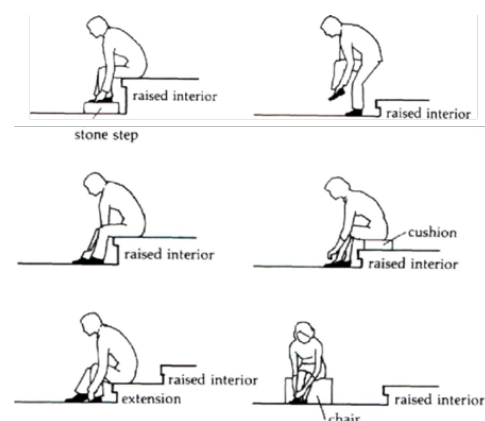


Fig.7 Suggested layouts for entranceway with and without accessories (Yagi, 1982)

12 | THE TRADITIONAL JAPANESE HOUSE

12.3 | SCREENING DEVICES

12.3 | SCREENING DEVICES¹³

"It is an accepted fact that natural light has a positive effect on our psychological state of mind, enhancing creativity and productivity. It also helps reduce reliance on artificial light, thereby mitigating that increasingly familiar measure, the carbon footprint. This partly explains why *shoji* screens, sliding panels of paper attached to a wooden lattice, are perhaps the most popular Japanese design element incorporated into Western interiors" (Gong and Parramore, 2009: 86).



Fig.8 Byobu. Source: <<https://s-media-cache-ak0.pinimg.com/564x/3b/d6/ac/3bd6ac3de510c7bd62cd9e3de824055c.jpg>>- accessed 11.06.16



Fig.9 Tsuitate. Source: <<http://takebamboo.com/screen/image/bam04n.jpg>>- accessed 11.06.16



Fig.10 Noren. Source: <<https://s-media-cache-ak0.pinimg.com/736x/a8/62/67/a86267bd044181184c69e6de1a33dcee.jpg>>- accessed 11.06.16



Fig.11 Manmaku. Source: <http://blogs.c.yimg.jp/res/blog-5c-20/chief_hopi/folder/262956/47/11487147/img_1?1401723056>- accessed 11.06.16

Folding screening (*byobu*), single-panel screens (*tsuitate*), doorway curtains (*noren*), *sudare* blinds, and running curtains (*manmaku*) are all part of a furniture category called *byôshogu*, whose role may be to break down the lines of vision, to protect the sleeper from cold drafts, to create divisions or to simply decorate the interiors.

¹³ This topic's information source is:

Koizumi, Kazuko (1986) *Traditional Japanese Furniture*. Kodansha International Ltd., Tokyo;
Gong, C. and Parramore, L. (2009) *JAPAN HOME Inspirational Design Ideas*. Tuttle Publishing, Singapore;
Yagi, Koji (1982) *A Japanese Touch For Your Home*. Kodansha International Ltd., Tokyo;
W. Barr, Cameron (1999) *The Japanese Way of Keeping their Homes Warm* in <<http://www.csmonitor.com/1999/1231/p7s1.html>>-accessed 16.05.16;

12 | THE TRADITIONAL JAPANESE HOUSE

12.3 | SCREENING DEVICES

These partition devices come in a varied sort of materials: there are paper panels, cloth, *shoji* panels, reeds, imported rare woods, domestic woods, bamboo and wire mesh. *Sudare*, woven blinds of reed or bamboo—still used in the old capitals of Kyoto and Nara—usually replaced *shoji* panels in the Summer. They were placed inside, hanged from the windows, and were indispensable for shading out the sun while letting a breeze in the Summer. They allowed for privacy as they allowed those inside to see out, while only letting out blurry silhouettes of the interior. To remove them it was as easy as rolling them up. There are three varieties: bamboo blinds (*take-sudare*), reed blinds (*yoshi-sudare*) and *Iyo* bamboo blinds (*Iyo-sudare*).

Tsuitate can serve to visually conceal or enhance and can be used indoors as well as outdoors. Indoors they are usually placed between *engawa* verandas and drawing rooms, in the *genkan* or at the entrance of the sleeping quarters (Koizumi, 1986:91). Opaque sliding partitions known as *fusuma*—sometimes painted with nature scenery—were used as closet doors or room dividers and were covered with gold-leaf paper that reflected light in the inside.

The amount of natural light in a Japanese room can be managed through the use of translucent *shoji* panels. While paper *shoji* can diffuse strong sunlight, the gold-leaf folding screen at the opposite side, can reflect it. Furthermore, *shoji* screens can adjust the exterior in a visible frame while visually protecting the residents from the neighboring houses. *Shoji* panels were intrinsically incorporated in the family life. They implicated annual maintenance tasks that were happily taken, especially by the children. The children did like repairing the *shoji* panels because it allowed for creativity in the shapes of the paper patches that cast fun shadows, but they also enjoyed tearing the *shoji* panels while playing. These panels were commonly composed of *washi* paper, Japanese hand-made paper also applied to umbrellas due to resistance to the rain. (Gong and Parramore, 2009:10,32,86).



Fig.12 Partitioning a large room (Gong and Parramore, 2009)



Fig.13 Sudare and Shoji blinds (Gong and Parramore, 2009)

12 | THE TRADITIONAL JAPANESE HOUSE

12.4 | DINING FURNITURE

12.4 | DINING FURNITURE

Traditional dining surfaces were comprised of tray-tables (*zen*), boxed tray-tables (*hakozen*), dining tables (*chabudai* and *zataku*), and box-legged trays (*kakeban*). There was a communal use of a dining table—the *daiban* banquet table—in the *Heian* period (194–1185), although the custom was replaced by individual tray-tables in the Middle Ages (1185–1573). It was only with the introduction of Western furniture in the *Meiji* era (1868–1912) in the cities—and the *Taisho* (1912–1926) and *Showa* (1926 – present) eras in the countryside—when a communal dining custom returned in the form of a low *chabudai*. Indicated for floor seating, the *chabudai* table—which could be round, oval or rectangular—also had collapsible legs for an easy storage. The *zataku* table later emerged from the dissemination of the *chabudai* table, as special dining furniture to use when entertaining guests (Koizumi, 1986).

Recently, a low table called *kotatsu* became very popular due to its central electric heating device, attached to the bottom of its surface. Since the Winter seasons are very cold in Japan—and the houses were made for surviving the Summer—keeping the house warm can become very costly. The *kotatsu* came to assist this problem providing not only an infrared heating device but also a removable dining surface that can maintain the heat. This removable surface allows for the tucking of a thick blanket that can cover the legs of all family. In the Summer this cover can be removed. Perfect for cold days in the Winter, it is commonly used for comfortably dining and gathering at night. When a family is set under a *kotatsu* table, there may be little space under it for everyone's legs and so sometimes it's placed on top of a sunken floor area called *horigotatsu*, to facilitate the placing of the feet and allow for a more comfortable position. The person can either sit directly on the floor or on top of a *zaisu* (a legless chair). Other modern ways to heat the house may consist of floor heating through hot water piping or electric mats (Gong and Parramore, 2009; W. Barr, 1999).



Fig.14 *Kotatsu's* heating device. Source: <<http://travelista1.files.wordpress.com/2012/02/kotatsu.jpg>>- accessed 31.12.14



Fig.15 Working in a *Kotatsu*. Source: <<http://s3files.core77.com/blog/images/kotatsu2.jpg>>- accessed 31.12.14

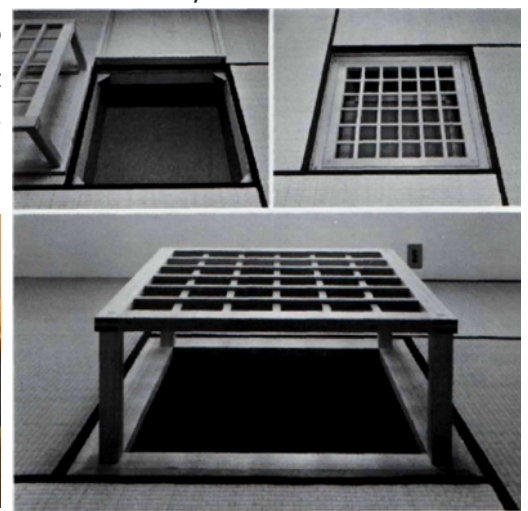


Fig.16 *Kotatsu*. In the summertime, the table frame is stored in a floor cavity and covered either with a piece of *tatami* or wood (W. Barr, 1999).

12 | THE TRADITIONAL JAPANESE HOUSE

12.5 | LOW AND LEGLESS CHAIRS

12.5 | LOW AND LEGLESS CHAIRS

When dealing with a floor-sitting culture such as the Japanese, it's important to understand what the contextual role of the chair is—in the West it's one of the most valuable pieces of furniture—so that the apparently uncomfortable floor-living positions can look more plausible for a Westerner.

For the purpose of the following compilation the author intended to compare the evolution of the chair in a floor-sitting culture, such as the Japanese, and in a medium-to-high-sitting culture such as the Western. However, after a lot of research difficulties the author learned that there was not enough information about the chair evolution in Japan. Although maybe hard to believe (if we think of how many books there are on chair design in the Western culture), Kazuko Koizumi explained it in “Traditional Japanese Furniture”:

“Since neither chairs nor raised beds were used in the traditional Japanese home, the variety of *zagagu*, furnishings for sitting and reclining, was extremely limited. Articles for raised seating—*koshikake*, literally ‘furnishings on which to hang the hips’—can be counted on the fingers of one hand: bentwood chairs (*kyokuroku*), benches (*endai*), campstools (*shogi*), and stools (*ton*)” (1986:99).

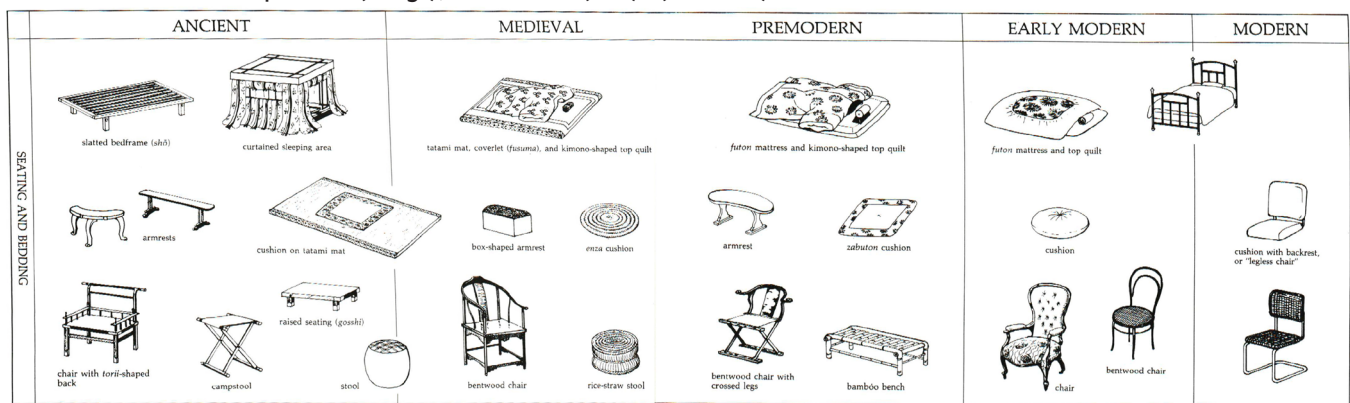


Fig.17 Illustrated History of Japanese Furniture “Seating and Bedding” (Koizumi, 1986:216)

Apart from famous Japanese designer chairs, that are rarely low leveled, there is almost to no information on low level chairs in Japan until the year of 2000. For this reason the author chose to collect the lowest leveled Western chairs instead, for that time period until the year 2000. From the 1900s to the year of 2000 we are presenting chairs produced in Europe and the USA that had close-to-the-floor levels. From 2000 to 2010 we are showing modern commercial Japanese chairs that were inspired by their traditional sitting culture. Although *zaisu* chairs were already produced before the year 2000, there isn't any information available about the first mass-produced *zaisu* chair. Still not with a traditional *zaisu* shape, these were the only *zaisu* chairs the author could find information about, in the decade of 2000. Their materials diverge from plywood to hard wood but typically a *zaisu* chair won't move away from this material unless the purpose is comfort instead of assistance in the everyday floor-sitting tradition.

12 | THE TRADITIONAL JAPANESE HOUSE

12.5 | LOW AND LEGLESS CHAIRS

The following chronologic figure, by the author, contains an overview of the evolution of American, European and Japanese low chairs from 1900 to 2010.¹⁴



Fig.18 Low chair evolution overview (Author, 2014)

¹⁴ For a complete historic study you can consult Appendix 1: "American, European and Japanese Low Chairs from 1900 to 2010" by the author.

12 | THE TRADITIONAL JAPANESE HOUSE

12.6 | IRORI

12.6|IRORI

The Western living-room fireplace had its equivalent in the form of an indoor hearth in the traditional Japanese house. Cut into the floor, it offered heating for the gathered people and it was where some cooking preparations took place—like the tea brewing. It was placed in the middle of the room to allow for a 360° degree heating—contrary to the wall-built Western fireplaces. Because there was little furniture, the proximity to the *irori* was increased as well as the feeling of intimacy of the gathering.

The current living installments are no longer appropriate for the traditional *irori* hearth, but sunken areas didn't cease to exist in the Japanese room. Like mentioned before, the *horigotatsu* holds the legs under a *kotatsu* table—now one of the main sources for heating. "In 1997, two-thirds of Japanese homes had an electric carpet - the modern-day *irori* - and 81 percent had a *kotatsu*, although today they are warmed by electricity, not glowing coals" (W. Barr, 1999). Although old-fashioned, *irori*s are recently growing among the Japanese urban dwellings.



Fig.19 Irori (Gong and Parramore, 2009)

12.7|TATAMI¹⁵

Spread around the entire Japanese traditional floors, the *tatami* mats were made from woven straws and measured approximately 90 x 180 cm. Their sizes were standardized and determined by human measurements. In the same way that bricks were made proportionally to the size of a hand, *tatami* mats were designed to fit a sleeping person or two standing people. Because of its standardization and relation to other standardized elements, like partitioning devices, the combination of *tatami* mats was used to establish the size of a room.

They were permanently settled for standing (shoe-less), sitting and sleeping. For sleeping it was customary to place a futon mattress, which provided a surprisingly comfortable way to sleep. In the morning the futon would



Fig.20 Tatami Room (Gong and Parramore, 2009)



Fig.21 Tatami Room. Source: < <https://www.haikudesigns.com/assets/images/furniture/tatami/tatami1-large.jpg>>- accessed 31.12.14

¹⁵ This topic's information source is:

Koizumi, Kazuko (1986) Traditional Japanese Furniture. Kodansha International Ltd., Tokyo;
Gong, C. and Parramore, L. (2009) JAPAN HOME Inspirational Design Ideas. Tuttle Publishing, Singapore;
Yagi, Koji (1982) A Japanese Touch For Your Home. Kodansha International Ltd., Tokyo.

12 | THE TRADITIONAL JAPANESE HOUSE

12.7 | TATAMI

be stored away to make the room accessible. Even today when a Japanese room has a bed it is usually a low-platform one.

It was also important to let the *tatami* floor breathe and occasionally air in the sun. Its continuous presence throughout the centuries lead to a general feeling among the Japanese of familiar pleasure when interacting with *tatami* mats. They are appreciated for their smell, touch, comfort and relationship to the traditional Japanese culture.

12.8 | TATAMI STORAGE 高床式畳収納

When houses in Japan became more Westernized, they still maintained at least one room with the traditional style. Tatami mats are one of the most common ways to make a room into a traditional style. Nowadays there are other ways to integrate the tatami, for example in the form of floor boxes with storage and *tatami* lids. On top of these boxes they can have tea ceremonies or family gatherings in a more traditional way.

Sometimes this storage can include a hole in the middle, equivalent to the original *horigotatsu*, where they can put a table on top. There are many different kinds of boxes available, some with electrical sockets, and all approaches seem to suggest it's used only for a partial covering of a room. They don't have the purpose of replacing all the floor, although in Japan that would be easy to do because the houses have standard dimensions, measured by the number of *tatami* mats in length and width. It's possible the reason people don't cover all the floors with this *tatami* storage, hence imitating the traditional room, is because it would either: be very expensive (the second photo sells the set for 1,882.44€), have no valuable advantage to just filling a room with tatami when there's no need for extra storage, or it would leave all of the options with underneath drawers unfunctional.

Searching for these boxes in the internet could only be fully achieved when searching with the Japanese alphabets.

高床式畳 - Stilts *tatami*

高床式畳収納 - Stilts *tatami* storage

掘りごたつ - *Horigotatsu*

12 | THE TRADITIONAL JAPANESE HOUSE

12.8 | TATAMI STORAGE



Fig.22 Tatami Storage¹⁶

12.9 | TANSU¹⁷

One of the most common household traditional Japanese furniture was the *tansu*, a drawer, chest type of furnishing that appeared in the latter half of the 17th century. By the time of the Meiji Restoration (1868-1912) there were many types of *tansu* used for storing money and “virtually every possible item”, but the most common type was the clothes chest, *isho-dansu*, and the second most common was the tea chest, *cha-dansu*. At the time, no one had thought of the possibility to hang clothes, and thus every household folded and stored clothes in the *isho-dansu*.

¹⁶ Source: Appendix 4

¹⁷ This topic's information source is:

Koizumi, Kazuko (1986) Traditional Japanese Furniture. Kodansha International Ltd., Tokyo.

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12.9 | TANSU

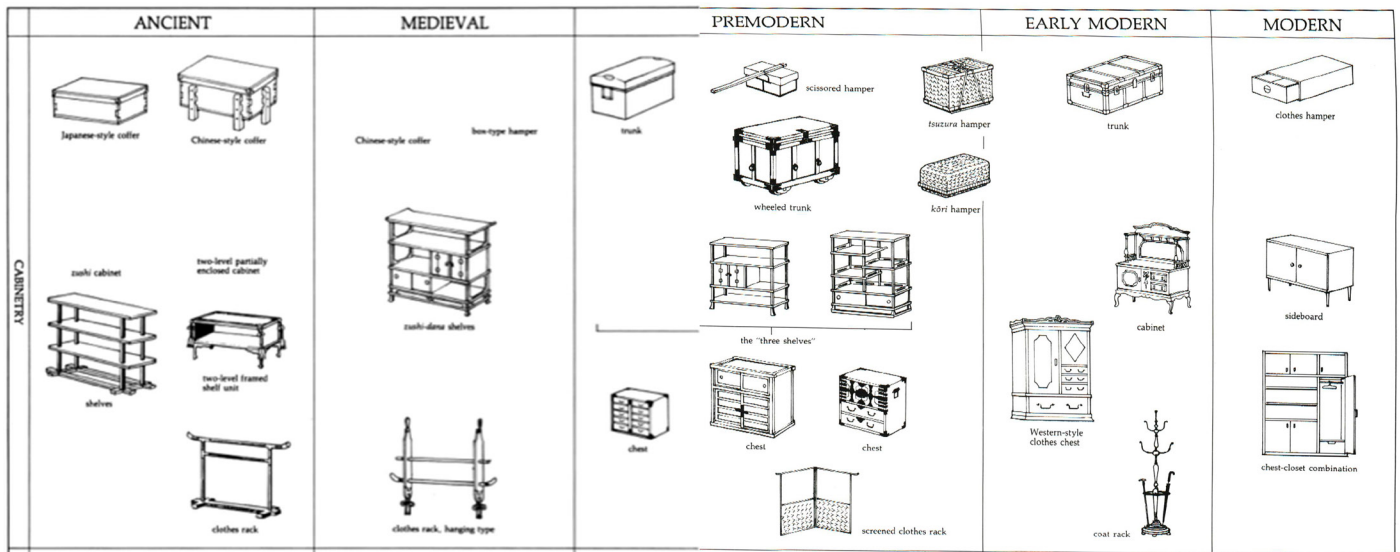


Fig.23 Illustrated History of Japanese Furniture "Cabinetry" (Koizumi, 1986:214)

Tansu in Japan had a profound exploration of shape and functional varieties that weren't common and maybe didn't exist in the West.

For instance this ladder chest from the early 20th century, retained an idea of stairway storing that was only recently disseminated, in the modern Western house, with the aid of Internet design platforms, such as Pinterest.



Fig.24 Stairway chest (Koizumi, 1986:25)



Fig.25 Stairway storage¹⁸

¹⁸ Source: <<http://www.pinterest.com/pin/185773553351852281/>>- accessed 31.12.14

12 | THE TRADITIONAL JAPANESE HOUSE

12.10 | VERANDA

12.10|VERANDA

The veranda or *engawa* is one of the intermediary places of a Japanese traditional home. Usually it's a place to entertain friends, relax with the family and get closer to nature (Koji, 1982).

12.11|GARDEN¹⁹

"It is raining. If you are inside a typical Western home, you might not even be aware of the rain. In a traditional Japanese home, the window openings are wide and the sills, if there are any, are low. The solid roof above spreads its eaves protectively around the house and frames the garden for you to enjoy during the rain. Seeing the garden glisten in the rain, you feel peace and serenity" (Gong and Parramore, 2009:8).

Katei is the Japanese word for the ideal living space that includes both the house (*ka*) and garden (*tei*). Visible from the interior and intermediary spaces, the Japanese gardens have a lot of planning, thought and contemplation dedicated to them. It is one of the Japanese features attracting to many Westerners, because it transports a serene atmosphere with it.

12.12|ESTHETICS²⁰

"If, as proposed by a Japanese anthropologist, Western culture originated in the world of the desert, then perhaps the desert dwellers' view of the universe gave birth to monotheism and saw beauty in perfect symmetry that has little relevance to nature as a whole. And, if, in contrast, Japanese



Fig.26 Engawa (Gong and Parramore, 2009)



Fig.27 Engawa (Gong and Parramore, 2009)



Fig.28 Garden (Gong and Parramore, 2009)

¹⁹ This topic's information source is:

Gong, C. and Parramore, L. (2009) JAPAN HOME Inspirational Design Ideas. Tuttle Publishing, Singapore.

²⁰ This topic's information source is:

Reynolds, Garr (2009) 7 Japanese Esthetic Principles to Change Your Thinking in <<http://www.designprinciplesftw.com/collections/7-japanese-esthetic-principles-to-change-your-thinking>> -accessed 16.05.16;

Yagi, Koji (1982) A Japanese Touch For Your Home. Kodansha International Ltd., Tokyo.

12 | THE TRADITIONAL JAPANESE HOUSE

12.12 | ESTHETICS

culture is seen to have originated in the chaotic world of the forest, then perhaps the pantheism that evolved led to an appreciation of the unbalanced harmony in the tension created by dynamic forces locked in unresolved conflict" (Yagi, 1982:7).

There are many Japanese esthetic concepts that define the Japanese perspective on beauty and its connection to nature. There is a general Japanese tendency to leave the unexplainable unexplained. This is associated with the notion that an unexpressed feeling is closer to the truth than expressions. "*Chimmoku wa kin, yuben wa gin*", is a Japanese proverb that means: eloquence is silver, silence is gold (Prasol, 2010:70).

Wabi (simple quietude) and *Sabi* (elegant simplicity), (*wabi-sabi* 侘寂) is an esthetic style that emerged from the Zen Buddhist movements and intends to find beauty in the non-materialistic spirit and harmony of nature. It's usually portrayed in raw, asymmetric objects with deep spiritual feelings.

Kanso (簡素) means simplicity or the removing of what is too much. It is expressed in flat, simple and natural forms. It helps us value things in terms of clarity, by omitting what isn't essential, rather than enhancing the decorative aspect.

Fukinsei (不均 整) means asymmetry or irregularity. The control over the balance of a composition, through asymmetry, is a key element of the Zen esthetics. Nature itself is full of beauty and harmony in their asymmetrical and balanced relations.

Shibui (渋 味) has to do with an implicit beauty, or with being precisely what was intended to be without developing beyond that. It is expressed in a direct way and is simple without drawing much attention. The term is sometimes used to describe something cool but minimal.

Datsuzoku (脱俗) is the release from the habit. It's the escape from the daily routine and from the ordinary. It transcends the conventional in a surprising way. The Japanese garden itself is, "...made with the raw materials of nature and its success in revealing the essence of natural things to us is an ultimate surprise. Many surprises await at almost every turn in a Japanese Garden" (Tierney apud Reynolds, 2009).

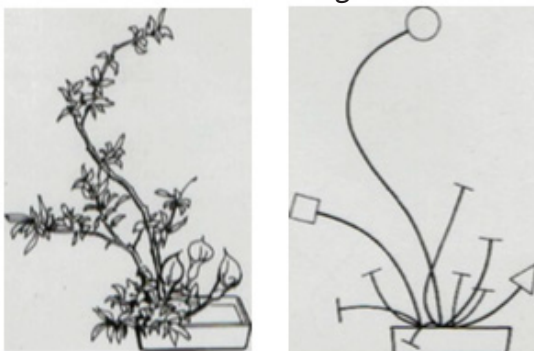


Fig.29 Asymmetry in Japanese flower arrangement (Yagi,1982)

12 | THE TRADITIONAL JAPANESE HOUSE

12.13 | HYGIENE

These are only a few Japanese esthetic styles, but there are more, like for instance: the *seijaku* (静寂), that describes the peace and calm that an object can carry and relates to notions of loneliness, stillness, opposite from noise and disturbance.

“What lies at the heart of the Japanese perception of beauty is the desire to reproduce nature, to achieve a fusion with nature, even in architecture, a most unnatural creation” (Yagi, 1982:8).

12.13|HYGIENE²¹

Finally the author is going to approach the Japanese hygiene preoccupation. Japanese people were accustomed to living in restrained spaces and sharing their surroundings with their families in a less private way that in the West. They are taught to have healthy cleaning habits since kindergarten age—children are told to brush their teeth three times a day, bathe and wash their heads with shampoo every day. This habit is naturally applied to their homing lifestyles as well, in the form of removing shoes at the entrance to preserve a clean floor.

Because the *tatami* mats could also be fractured with shoes or heavy furniture, the interiors became easy to clean and maintain. Also, even though a Japanese bathroom is very clean, there are special slippers placed in front of the bathroom door. But even these hygienic habits—that don’t have any strong equivalent in the West—aren’t satisfying enough when receiving a guest. In these special occasions, the housewife will prepare the house to a “museum-quality” appearance.

Japanese are so involved in hygienic habits, they will often go to day TV Shows and complain about the lack of efficiency of bathroom facilities and such. Japan is actually a pioneer on toilet development. They have developed complex toilets which have become the norm in newly built apartments. Their toilets are most famous for having: combos of toilet and sink; having seat heating; and having water jets that sprinkle up to clean the body.

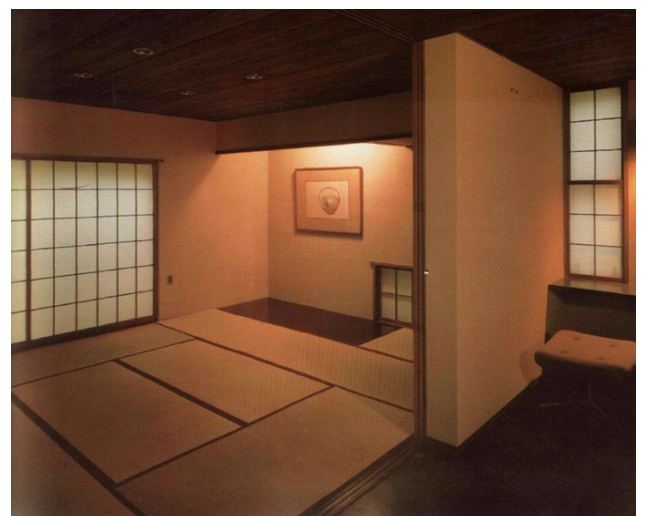


Fig.30 Clean room with easy maintenance (Yagi,1982)

²¹ This topic’s information source is:
Prasol, Alexander (2010) MODERN JAPAN Origins of the Mind. Japanese Mentality and Tradition in Contemporary Life. World Scientific, Singapore.

13 | GLOBAL STRUGGLE WITH LACK OF SPACE²²

When we look at the current situation of the biggest cities in the world, like New York, London or Tokyo, we can already see the problems that have surfaced due to overpopulation. In the short term there won't be room for more buildings and this will make the existent houses increasingly expensive.

According with the UN Population Division study of 2012, by the year 2070 the world population will reach 9.3 billion people. Before that, in the year of 2040 New York City will reach 9.2 million and won't have a place to put all the new people. 55 new micro apartments are beings constructed in the "My Micro NY" building in New York. They will only be 23-34m² (which is a number much closer to the average floor space per person in China which is of 20m²). These micro homes would sell for less money which would allow a greater number of young people to be able to buy property. Rents will be ranging from \$939-1 873 vs. the present \$2 000.

In 1950, an average of 3.37 people lived in each American home. In 2011, that number had shrunk to 2.6 people. The average size of a new American home in 1950 was of 983ft² and in 2011 that number grew to 2 480ft². This means that we take up more than three times the amount of space per capita than we did 60 years ago.

In London thousands of "micro homes" of 23m² should be built as part of a nine-point plan to tackle London's housing crisis, according to a leading Britain architect. The number of young people able to buy property in London would be doubled.

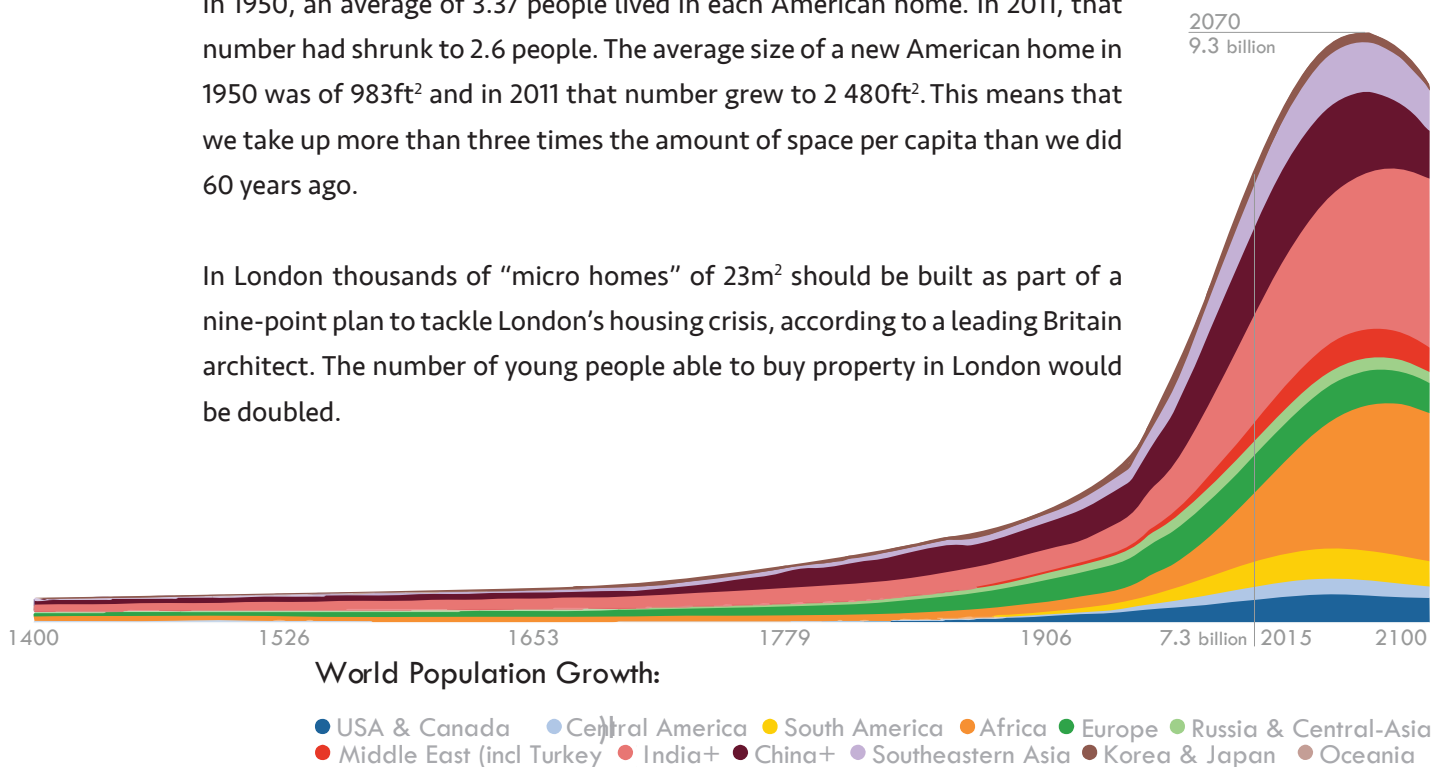


Fig.31 World Population Growth. Adapted from Source: <<http://ourworldindata.org/data/population-growth-vital-statistics/world-population-growth/>>- accessed 16.05.16

²² This topic's information source is:

Tokyo style micro homes in <<http://www.standard.co.uk/news/london/tokyostyle-micro-homes-with-just-250-square-feet-of-space-will-help-solve-london-housing-crisis-a2952696.html>>- accessed 31.12.14

Micro Apartments in <<http://www.rawstory.com/2013/06/nyc-goes-the-way-of-tokyo-micro-apartments-proposed-as-solution-to-overcrowding/>>- accessed 31.12.14

Tiny Apartments in <<http://www.theguardian.com/sustainable-business/2015/apr/08/tiny-apartments-modular-housing-affordable-skyscrapers-cities-community>>- accessed 31.12.14

World Population Growth in <<http://ourworldindata.org/data/population-growth-vital-statistics/world-population-growth/>>- accessed 31.12.14

14 | LIVING SPACE PER PERSON²³

To build these micro-homes companies are using modular construction which is faster, less expensive and allows for high levels of quality control while also reducing waste and truck traffic. Modular construction isn't a new concept. But what is currently innovative is putting completed units together to form high buildings in big cities. The main issue with modular buildings is their adaptability. They are difficult to fix over time and don't integrate changes in lifestyles or changes in uses. In New York, modular buildings may not allow people to participate in trending community.

"Because of the nature of cities like London, Mexico City and Tokyo, for example, people are willing to live in smaller spaces so long as they are maximized for efficiency and have other desirable amenities." (Jorge Mastropietro in Moodie, 2015)

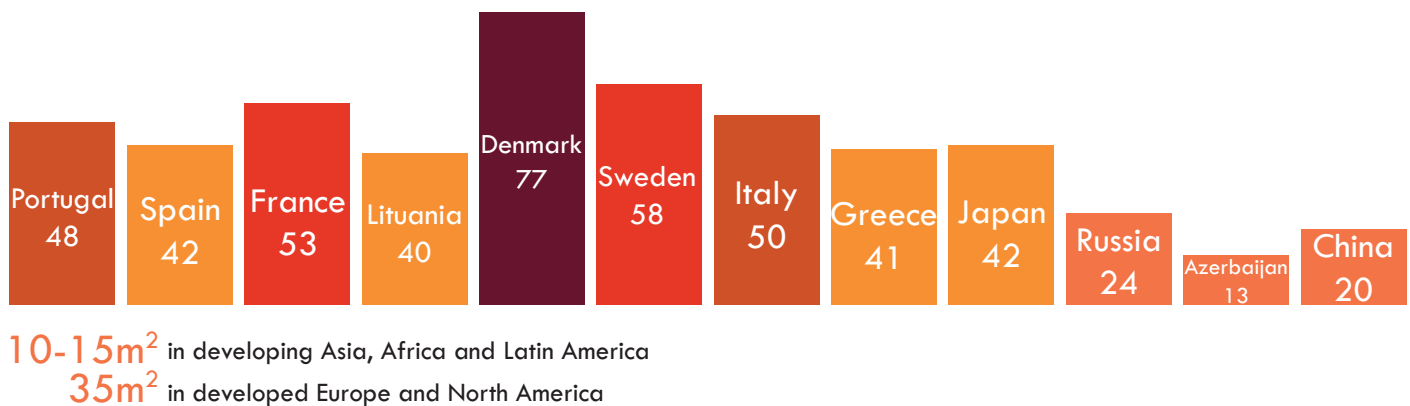


Fig.32 Average floor area per capita (Author, 2015)

We can see from this graphic on the average floor area per person, by country, that in the developing countries of Asia, Africa and Latin America, the average floor area per person is 10-15m² square meters. While in the developed countries of Europe and North America the average is 35m².

It is possible to find cultural, economical and climatic reasons for the estimated floor area per person. For example, in Manila (one of the most dense cities of the world located in the Philippines), the average floor area per person is 12m² which can be explained by the low

²³ This topic's information source is:

India's urban poor in < <http://www.theguardian.com/world/2008/nov/26/india-national-survey-urbanisation-poverty>>- accessed 31.12.14

Dwellings in Hong Kong in < <https://www.hongkongfp.com/2015/07/27/the-unlivable-dwellings-in-hong-kong-and-the-minimum-living-space/>>- accessed 31.12.14

Housing stocks in < <http://www.helgilibrary.com/indicators/index/housing-stocks-sqm-per-person/germany>>- accessed 31.12.14

How big is a house in < <http://reneweconomy.com.au/2013/how-big-is-a-house-average-house-size-by-country-78685>>- accessed 31.12.14

Average living area in square meter per person in < <http://statinfo.biz/Geomap.aspx?act=1762&lang=2>>- accessed 31.12.14

Average floor area per capita in < <http://www.entranze.enerdata.eu/>>- accessed 31.12.14

Svetlana Kozhenova "Quality of the Living Space" in <http://www.hdm.lth.se/fileadmin/hdm/Education/Undergrad/ABAN05_2010/Kozhenova_Svetlana_-_Quality_of_the_Living_Space.pdf>- accessed 31.12.14

14 | LIVING SPACE PER PERSON

average income per capita and their tropical ecosystem with high temperatures. The hot weather also encourages families to use the home only to sleep and eat, and to spend all day outside to socialize with the community.

“How many square meters does the average person need? Instead of thinking of how large a house should or should not be, we should consider how much space each individual needs and why the needs of people around the world are so different.”
(Kozhenova, 2010)

Persons per room and households per dwelling unit are some measures used to compare distribution of space in the house, but floor area per person is the most precise. With economic development, floor area per person increases consistently. Sub-Saharan Africa and South Asia have the smallest floor area per person, and industrialized countries have the largest. Still, in the developed Asian, African and Latin American countries, the average is around 10-15m² per person, while in the developed European and Latin American countries, the average is around 35m².

According to the Indian government, 55% of the urban population lives, sleeps and cooks in a space equal to the minimum specified for US prisons - 5,5m². In the US the figure goes up to 83,6m². As for Hong Kong, some households opt to subdivide flats of only 47,8m² with its rents taking up around 40% of their income.

According to some opinions around the world, the ideal floor space per person is 250ft² which is equivalent to 23,22m² (the same as in London's and Manhattan's micro homes).



Fig.33 Chinese spaceless cubicles²⁴

²⁴ Source: <<https://www.hongkongfp.com/2015/07/27/the-unlivable-dwellings-in-hong-kong-and-the-minimum-living-space/>>- accessed 31.12.14

15 | MICROLIVING

The traditional Japanese house opened up our view to different ways of using our space in our home. By having no limits in our conception of how furniture should act and used in our homes, we can evolve to use it in a more efficient and beneficial way. Next, we are going to analyze the subject of microliving, how it affects our quality of life and what are some innovative ways to use space and furniture. This research will be the primary source for the development of an extensive space-saving furniture inventory.

A microdwelling is a small apartment which usually includes a kitchen, a bathroom and a window. The size of a microdwelling may be different in every country and city. According to the Department of Housing Preservation, in New York City it is by law no smaller than 400 square feet—equivalent to 37m² (Curbed Staff, 2015).

The SRO, Single Room Occupancy apartment, is a type of microdwelling which has neither a personal kitchen nor bathroom, only shared kitchens and bathrooms with other occupants. This condition allows for smaller legal room sizes, which in New York must be of at least 150 square feet (13m²), and they must have a window, an accessible fire exit and lodge only one tenant (Curbed Staff, 2015).

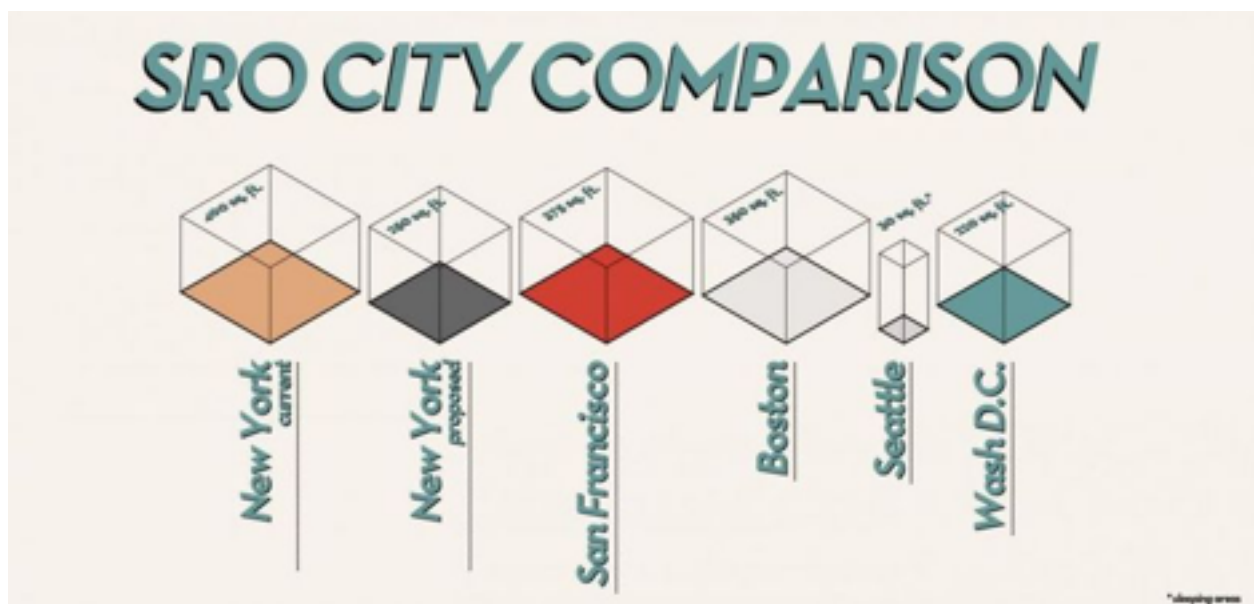


Fig.34 SRO City Comparison²⁵

Although New York is one of the most densely populated cities in the world, it isn't the one allowing for the smallest micro homes in the US. Seattle's residential code doesn't have minimum size requirements. Since 2008 Seattle has developed 2 300 units of micro homes allowing for sleeping areas as small as 30 square feet—2,8m² (Ionova, 2013).

²⁵ Source: <<https://nextcity.org/features/view/the-80-a-week-60-square-foot-housing-solution-thats-also-totally-illegal>>- accessed 19.06.16

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Recently, in 2012, there has been dialogue promoted by former Mayor Michael Bloomberg who, in response to the rising cost of studio apartments, proposed the development of a new type of housing in New York City, the micro unit. This micro unit will have a size ranging from 250-320 square feet (23-30m²). Although not the smallest New York has seen in its history, these units will have to be exempt from zoning regulations to make them legal and it would be the first time an entire stock of micro apartments would be built in the city (Ionova, 2013).

Looking back to the period of 1820-1860, in which the population grew by over 600 percent in New York, it wasn't possible to keep up with the needed speed to build housing, given that they only had basic machinery. And so, downtown immigrants had no choice but to live in tenements, while uptown, in the undeveloped areas, they built "squatters' shacks". These would appear regularly in the newspapers mostly due to fires or crimes (Dalzell, 2015).

"An 1865 report by the Council of Hygiene offers a rare description:

The shanty is the cheapest and simplest domicile constructed in civilized communities. The typical shanty is built of rough boards, which form the floor, the sides, and the roof...It is from six to ten feet high...It contains no fireplace or chimney, but a stove, the pipe from which passes through a hole in the roof. It has from one to three or four windows...Shanties are usually built promiscuously over the ground, without the least regard to order" (Dalzell, 2015).

In the second half of the 19th century, shanties were gradually replaced by tenements around Kips Bay. They had an average of 284 square feet (26m²) and lodged up to four people. But then there were major cholera and yellow fever epidemics and:

"according to Richard Plunz's exhaustive 'A History of Housing in New York City', a doctor researching the 1819 cholera outbreak compared those living in cellars and those above ground: 'out of 48 blacks, living in 10 cellars, 33 were sick, of whom 14 died; while out of 120 whites living immediately over their heads in the apartments of the same house, not one even had the fever.' It took many fires, riots, and deaths for the government to do something about this disparity" (Dalzell, 2015).

In 1865 a survey conducted by the Council of Hygiene found that from the 700 000 city's residents, over 480 000 lived in tenements. It also compared the square footage in rich and poor dwellings. In a private family home with eight people, each one had 100 square

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feet and 4 000 cubic feet of air. In contrast in the eight-family houses with 30 to 40 people, each one had 15 square feet and 400 cubic feet. And while the report recommended that each person have at least 800 cubic feet of air, when the Tenement House Act in 1901 was passed, it stipulated only 400 cubic feet of air per adult and 200 per child. Also, it was stipulated that windows should bring air and light into apartments, and rooms should have at least 120 square feet, with other rooms having at least 70 square feet. Later on, in 1955 all new construction of single-room housing was banned due to a deep belief that it caused substandard housing conditions. In 1970, these old tenements were destroyed under the pretext of being designated a slum, and eight new buildings called Phipps Plaza were built with studios of 375 square feet, 35m² (Dalzell, 2015).

Nowadays Seattle, which invested in a large number of microdwellings, built units with individual bathrooms but shared kitchens like in a SRO. The rents are more affordable and range from \$525 to \$700 per month. But still, cities are reluctant to allow private developers to build SRO's because these units could be the new low-priced studios, and the studios would become overpriced. The groups who usually receive permission to build SROs are funded to aid special-needs tenants like homeless veterans, the mentally ill, domestic abuse victims or people with AIDS. This leaves the rest of the low-income population, including undocumented immigrants, out of a safe and affordable housing option. Even so, SROs are today's modern tenements and qualify as the city's worst habitation, which leads to it being undesirable by any neighborhood that fears the decrease of their quality of life (Ionova, 2013).

Nowadays it is estimated that there are more than 100 000 illegal SRO's in New York, and only 30 000 are legal units. This is very problematic since the number of single-person households in the city rose from 185 000 in 1960, to 700 000 in 1987 and 1.8 million today. Furthermore, there are many ways to circumvent laws, such as private renters that will rent 90 square foot rooms for \$1 150 and illegally partitioning buildings and pass mini apartments for "rooming houses". Also targeted to people that spend all day outside the home, this old mall built 225 square foot rooming houses that rent cheaply for \$750, but are ultimately not legal to serve as a home. "Rooming houses doesn't allow for cooking facilities inside the unit, but a confection microwave isn't considered a cooking device" so these residents have a full kitchen equipped with a dishwasher but without any designated cooking device. Another way to bypass the law and be able to have a small bedroom: "You're not allowed to put a door in the sleeping area because then it would create a sleeping space which is under building code also." (Dirksen, 2015)

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This explains why Bloomberg is financing 165 000 units under the “New Housing Marketplace Plan” that will be more affordable than anything else on the market. As similar as it sounds to modern-day tenements, Bloomberg says:

“the tenement problem was big families in very small (spaces). We’re not talking about that. We’re talking about one or two people who want something they can afford, and they don’t entertain or need big space” (Bloomberg in Devereaux, 2012).

This marketing is based on an estimate that 46,3% of households consist of a single person, and part of those spend more time socializing outside the home. 75% of these new units will have kitchens and bathrooms, while the “interior design will depend on affordability and innovative layouts that maximize space”. The plan is also to force population into high-dense areas in order to reduce car usage and greenhouse gas emissions to 13% below 2005 levels. And other city goals are to ensure future competitiveness and long-term economic success. (Posel, 2012).

However, some of the population is apprehensive to accept that the building of the new micro units is for the good of the people, making comments like “micro apartment is a real estate gimmick for tiny rooms” and “even a decorated jail cell is still a jail cell” (Evans and Adrastos in Dailey 2015). These comments are in response to many aspects. One of those is that these micro units are below legal minimum sizes and will be approved on the pretext of providing cheaper housing when that isn’t exactly the case. My Micro NY, is the micro design that won adAPT NY (a competition launched by Mayor Bloomberg in 2012), and from its 55 units only 40% will be rented below the standard market rate. 11 units will be rented for \$940 to families who earn 20% less than the area’s median income, other 11 units will be rented from \$1700 to \$1 800 and the rest will be rented at \$1 800. Jill Hamberg, a professor at Empire College and an urban planner who previously worked on SRO legislation, commented that “the units are below market but [they are] still not affordable to somebody who can only afford \$800” (Ionova, 2013).

This isn’t the only case of an over-priced tiny home in New York, there are many small homes, especially in the most expensive areas of New York, that sell for exorbitant amounts of money (mainly due to the very expensive furniture and equipment that intend to provide a luxurious experience). In 2015 NeighborhoodX compared annual rents of traditional studios to rents of micro units. This resulted in an interactive graphic that forecasts the price of a micro unit in various areas of New York, and the micro unit price is always more expensive than the current market. The analysis used numbers from the first micro apartment building in Carmel Place.

“Regular studio apartments in Kips Bay rent for an average of \$58.29/sq. ft. per year. Micro apartments at Carmel Place rent for \$98-115/sq. ft. annually, or an average of \$106.67 from available listings - approximately twice the price of the neighborhood

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Studios vs. Micro-rentals (Dec. 2015)

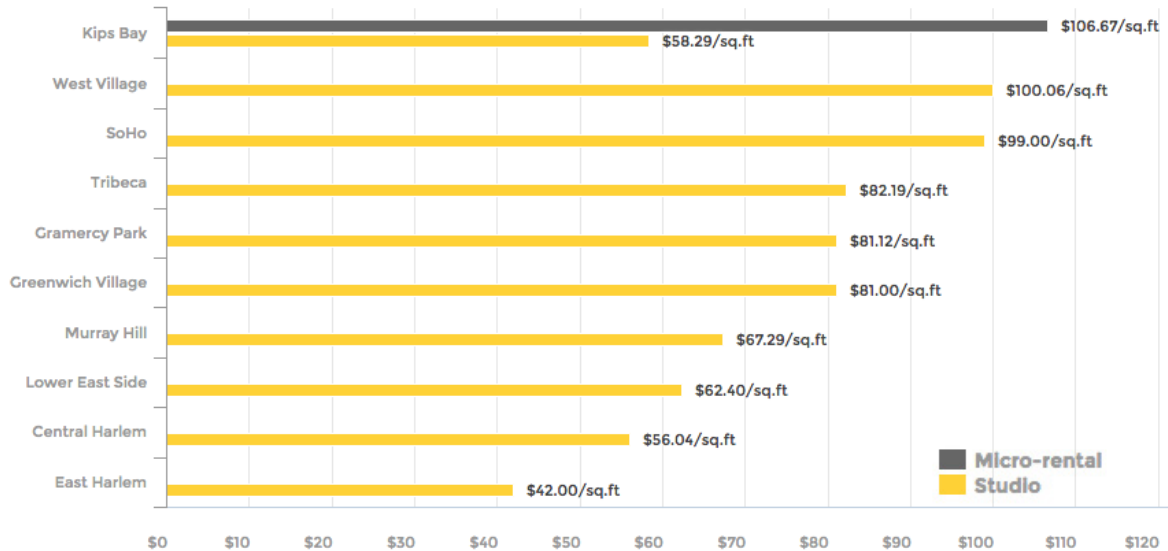


Fig.35 Comparison of Micro rental prices to current studio prices²⁶

as a whole. On a per-square-foot basis, these micro apartments generate more rent than regular studios in the West Village, at \$100.06/sq. ft.” (NeighborhoodX, 2015).

Amy Plitt explains it in Curbed—an online platform of social communities for NY’s housing market—that:

“apartments in Carmel Place are brand-new, for one (and some are even fully furnished), but also come with a whole slew of amenities, including a residents’ lounge, an apartment ‘manager’ (sort of like a combination of a butler and a super), social events, and work-live spaces in the building” (Plitt, 2016).

Nevertheless the quality appliances, the new micro units were authorized under the premise of providing affordable housing, and while attempting to make these affordable tiny homes comfortable and practical, they ended not serving the purpose and, worse, they run the risk of raising the minimum cost of living.

With the support of the Museum of Design of New York, the micro living has had a lot of promotion, with the successful exhibition “Making Room” in which designers and industry got together to discuss the building of smaller houses. It had a lot of success not only welcoming a large number of interest from the industry and the population, but also

²⁶ Source: <http://www.neighborhoodx.com/public/ny_micro_rentals>- accessed 19.06.16

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explaining the apparent need to build new micro homes. The reasons presented were the imminent danger in clandestine housing that didn't have safe exit-ways in case of fire; and the growing population tendency to live alone and therefore the need for more one-person apartments (Posel, 2012).

Figure 1. Share of U.S. Households Consisting of One Person Living Alone, 1940-2010⁹

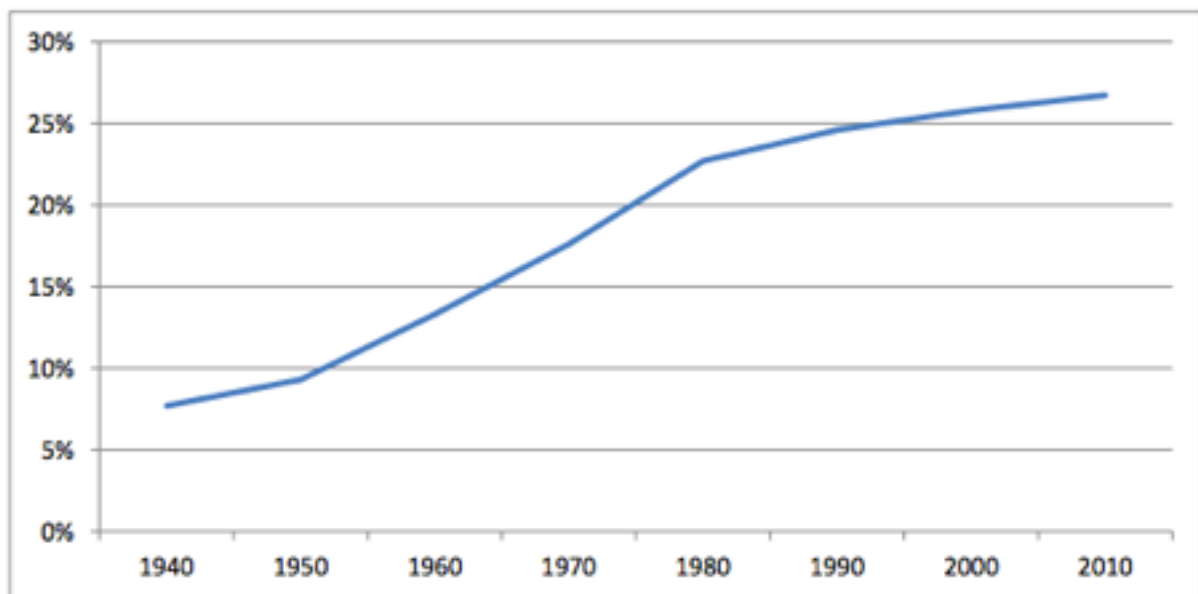


Fig.36 Evolution of population living alone in the U.S.²⁷

Apart from exhibiting some of the micro design entries to the adAPT NY competition, the Museum also built the winning design to let the visitors experience what a micro home is.

"Partnering with Resource Furniture and Clei s.r.l., an Italian transformable furniture company, we built a full-scale, fully furnished 325 sq. ft. apartment in the exhibition. Transformable tables, bed systems, and seating allow the compact space to be reshaped into five different configurations. The exhibition also highlighted examples of innovative housing types that are being built in other American cities, including Providence, Seattle, and San Diego. It also shows examples from some international cities, with a particular focus on small spaces in Tokyo. Through floor plans, photos, and multi-media, the exhibition dissected the homes and the design processes that generated them, and reveals the many features that enable them to accommodate challenging housing needs while providing comfort, a sense of spaciousness, and a high quality of life overall. The international section also included a narrative description of the history of compact and efficient homes in Japan" (Making Room, 2013).

²⁷ Source: <http://furmancenter.org/files/NYUFurmanCenter_RespondingtoChangingHouseholds_2014_1.pdf>- accessed 19.06.16

15 | MICROLIVING

Although they mention Japan as a leading example, in Tokyo and other big cities most micro homes don't come with luxurious items and do rent for a very affordable price. There, the laws have already been surpassed. They have smaller legal minimum sizes and they are allowed to have a stove and cooking appliances in very small areas. When looking out the window the view is composed of many high buildings full of many tiny homes and because the buildings are very densely populated, there is a serious lack of auditory privacy. The population grows less tolerant of neighbour's noise, which sometimes leads to violent crimes. Even so, there are many interesting micro designs in Japan, like very narrow homes with many stories. A lot of these designs try to fit a family home in "leftover" places in the streets, sometimes of the size of a parking lot.

Other examples around the world of the micro phenomenon include: Germany, where there's an 80cm wide house with six stories; Paris where old maid rooms are rebuilt to fully functional but outrageously small living spaces with kitchen and bathroom included (it is doubtfully legal); London there are also examples of very old homes that were remodeled into micro homes. In London there's also a company selling modular small homes with different layouts called CameraBuildings. But from every case and city researched in this topic, the only example of public awareness found, at the level of TV exposure, was in London and Hong Kong. In London they built a 12m² satire of micro home with a lot of flexibility and advantages but ultimately impossible to live in. "I mean it's not spacious", "Yeah, but that's literally the point. It's conserving space. Does it do it effectively?", "Yeah it bloody does" (Gadget Man, 2013).

ChannelofNewsAsia's documentary on Hong Kong showed a massive clandestine supply of housing that resulted from partitioning large spaces. In this city, the social housing isn't enough for the low class which forces a lot of people to live in terrible conditions, sometimes with their children, until they can afford a legal place. Hong Kong is so densely populated that the average apartment is 450 square feet. Unfortunately, these apartments have too many rooms and implications that render them uncomfortable. Journalist Christopher DeWolf talked to some residents who were able to remodel their apartments and had a few suggestions on how to improve them:

"So, just how can these flats be made useful? Many designers say their first course of action is to knock down as many walls as possible. 'That way we can do a completely new layout that is custom-made for the client,' says Gene Miao, who runs design firm 1:1. In his own flat, he got rid of a mahjong room to enlarge the kitchen. 'I like to cook so that was the first thing we decided to do,' he says.

Chan has devised other solutions for small spaces, including a raised living room platform with hydraulic storage, and bars instead of dining tables. Jason Carlow used most of the budget to renovate his own flat on built-in storage systems, including

15 | MICROLIVING

a ceiling-level bookshelf that visually separates the kitchen and living room while keeping the space open. Miao removed the false ceiling of his apartment, exposing the structural concrete, making the flat feel airier.” (DeWolf, 2015)

When it comes to Portugal, not a lot has happened on the subject of micro living. The only found case was of the Closet House in Matosinhos. In this 44m² home there was a sliding wall, pull-down kitchen cabinets, multi-purpose furniture, an extensible kitchen table and a very futuristic technological system that automatically controls lights and energy. It was built in 2010 and won the award for the Archdaily Building of the Year 2010 (Consexto, 2010).

Apart from this one finding, Portugal has a Tiny House web community and a few private builders of Tiny Houses. The Tiny House Movement emerged in the U.S. as a response to the incumbency of owning and paying for real estate to live in. Tiny homes are normally built on backyards or on to trailers so that owners can get away without paying for real estate taxes and land rentals. This allows the owners to have different lifestyles, employments and to travel more. In addition to reducing the ability to do different things inside the tiny home, owners have to cut down on almost all belongings because there isn't enough space to fit them in. These terms are frequently referred to as improvements from the traditional lifestyle because it scales down the value of material possessions and increases time spent with nature and outside social experiences.

João Neves, a Portuguese autodidact builder of tiny houses, makes them between 2m²-20m² with almost exclusively sustainable materials like wood, cork, fabric and sheep wool (which is great for insulation and absorption of humidity). The price ranges 3 000-6 000€ and his customers, usually from tourism, range 40-50 years old, being that he has sold to a 72 year-old but also a 30 year-old. In Europe this Tiny House movement has been growing in the 20-30 year-old range of population who is looking for cheaper options to live (Mini Casas Portugal, 2016).

“For many, living in a house the size of their parents' living-room (or smaller) can be a purgatory. But for others it is a dream home and before we call them crazy, just imagine a life without debts, without rents, virtually no cleaning and tidying, and free of the chaos and disorder our materialist “need” can bring... Imagine being free of loans and energy independent, in a space that gives us the essentials of life without neglecting the standards of comfort and decent living... Imagine the extra time that we gain and the concerns that will cease to exist... It seems utopian, but it's actually a more realistic option for many of us, and we know it's possible. Welcome to Tiny House Portugal!” (Tiny House Portugal, 2016)

16 | PORTUGAL'S REAL ESTATE²⁸

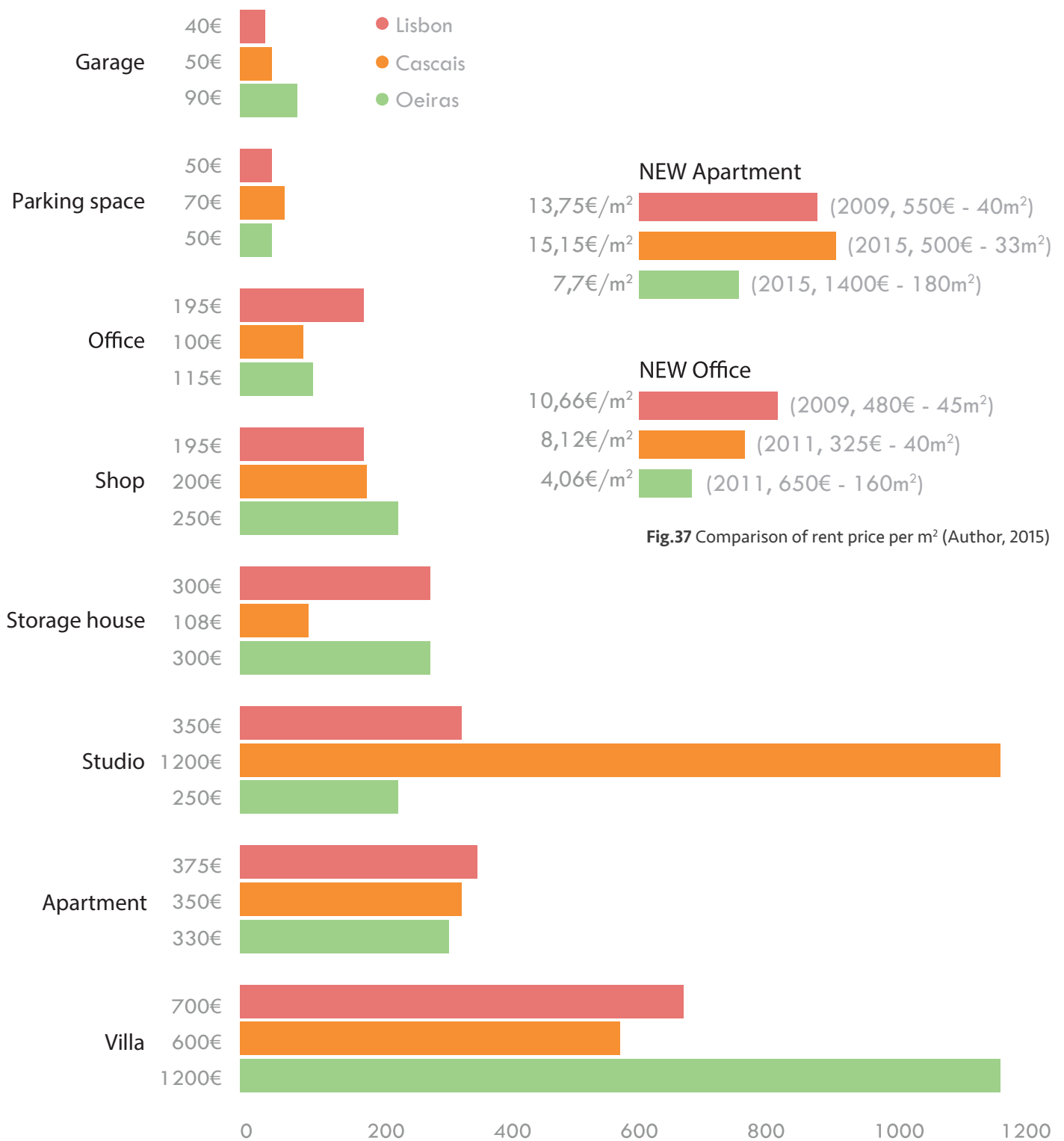


Fig.37 Comparison of rent price per m² (Author, 2015)

Fig.38 Minimum available price of rent per month for accommodation (by type) (Author, 2015)

²⁸ Market research on accommodation in the district of Lisbon, parish of Lisbon, Cascais and Oeiras
09/17/2015 Source: <casa.sapo.pt>- accessed 31.07.15

16 | PORTUGAL'S REAL ESTATE

When we look at the current situation of Portugal's real estate we can see that the apartment is the second most expensive space to rent. Mainly because the apartment has a kitchen and a bathroom, but when comparing to studios that also have them, the apartment is still more expensive.

The apartments compared are very small, sometimes a T0. The offices and shops are similar in size and all of them have bathrooms.

There is a big difference in €/m² between new apartments and offices. This difference may be due to the construction of divisions and walls, a kitchen and plumbing. It would be easier to live in an office-like space by using many portable kitchen tools (primarily for camping purposes), and if people started doing the laundry in a shop instead of inside the house.

Overview:

The studio: it's cheaper than the apartment. It's an open space with no walls and has plumbing for a kitchen.

The office: it's also cheaper than the apartment. Has less walls and sometimes has a modular ceiling which could be used as a base to put up flexible walls.

Downside: doesn't usually have plumbing for a kitchen.

The shop: cheaper than an apartment. Has a wide open space and big windows.

Downside: doesn't usually have plumbing for a kitchen. If located at a ground level, may have little security and privacy.

The storage house: it's usually small and with no walls, therefore very cheap.

Downside: doesn't have plumbing for a kitchen or a bathroom. Doesn't have many windows.

The apartment: has a bathroom and a kitchen and strong security. Doesn't have privacy problems.

Downside: it's not affordable for poor families or big families. Has too many walls that take up too much space.

17 | SPACE - SAVING FURNITURE

In the field of flexible furniture, the role of the Product Designer has been to develop smart and multifunctional furniture, household appliances, custom-made furniture and furniture that supports alternate house plants (including micro homes), such as moving walls with storage.

“Convertible Furniture: Furniture that folds up for ease of storage and portability has been with us for over two millennia. (...) But the twentieth century witnessed a flowering of designs for changeable or “motion furniture” and their production for mass markets in which such home furnishings create a home esthetic and encourage the development of a definite lifestyle.” (Cole, Browning, Shroeder, 2003)

As of 2015, although convertible furniture is not available in Portugal’s big furniture outlets such as IKEA, CONFORAMA, LEROY MERLIN, AKI and AREA, a smaller furniture manufacturing company called GenesisDecor offers redesigns of the Murphy bed as well as every kind of custom-made furniture for lofts, living-rooms, bedrooms and kitchens. Internationally one of the biggest outlets selling versatile and multifunctional furniture is Resource Furniture, the official US distributor for Clei—an Italian design company well-known for various design renditions of the Murphy Bed.

In order to help identify every possible furniture function, and reduce the need for custom-made furniture to satisfy dwellers’ needs, the author collected examples of flexible furniture which were separated into 8 categories: Storage, Tables, Seating, Sleeping, All in One, Entertainment, Bathroom/Laundry and Kitchen. This furniture classification index, intends to organize every type of flexible furniture existing, by assigning the following attributes to allow for an easier overview: Built-in, Compact, Extendable, Folding, Inflatable, Multifunction, Pulling and Stackable.

Built-in furniture is useful to add ceiling, wall, stair, floor and practically any kind of storage without taking up more space. By pulling drawers and doors from the wall can be convenient not only for storage but also for other items like a bathroom sink.

Compact furniture can squeeze various items into one multifunctional and, sometimes, portable piece. A compact furnishing may comprise various functions or even completely replace a conventional closet, office, lounge, living room, bedroom, bathroom or kitchen. It can remove the boundaries of the entire house space. If kitchens and bathrooms—the only unmovable areas in a house—gain portability, then we can reach the peak of a flexible house. Compact furniture is a great inspiration for futuristic designs where everything is possible.

17 | SPACE - SAVING FURNITURE

Extendable furniture is comprised mainly of extendable work surfaces like tables. Sometimes bookshelves and chairs can also be extendable. It has the advantage of duplicating the amount of furniture easily, quickly and without filling space when not needed.

Folding furniture is mostly present in tables, chairs, beds and sofas. It has two purposes. One, it allows for owning more furniture than one could fit inside a home. Folding tables and chairs are usually not an everyday object, they are mostly folded out for guests, so they can be stored away most of the time. Two, folding beds and sofas normally provide the added double function for seating and sleeping. They are also usually meant to accommodate guests, unless it's a very small house and there's no space to have both a bed and a sofa.

Inflatable furniture has been around for a long time. In 1968 British Pathé released a TV commercial presenting inflatable plastic sofas and how to use them. But inflatable furniture has had a hard time staying in the market because there is low demand. Nevertheless, inflatables have a lot of advantages that could be exploited for space-saving purposes. For one, it's an extremely flexible piece of furniture. It can create a three seat sofa in minutes. Then, it uses air as stuffing which is much better for the environment and also makes it cheaper to produce. It can be done in any shape and also looks comfortable. Inflatable furniture is almost all meant for seating and sleeping. Inflatable walls are largely used in events to create spaces with privacy and sound isolation for conferences, talks, etc. They are quickly assembled and very light compared to a normal wall. There are many layouts available and many companies that specialize in renting them.

Multifunctional furniture is any piece of furniture that has more than one conventional use. Giving more than one use to a piece of furniture has a giant advantage when it comes to saving space and having less amounts of furniture. Although the purpose is to add uses and not to save space, it may also help in that way.

Pulling furniture is either used to access top or bottom storage spaces by pulling doors and rails, or to uncover hidden furniture like tables and beds. It also includes flexible attached furniture that can be pulled in a specific mechanism, like the one used in walls. All of the other furniture that has wheels to help us with changing places, is not included in this category.

Stackable furniture is usually very modular and it's interesting to see that flexible modules with different positions, shapes and functions, can also be easily stackable. It is mainly used for stacking chairs and tables only used when having guests. It is also being used for building bookshelves by stacking modules. Stackable bookshelves are very portable and easier to transport than conventional bookshelves.

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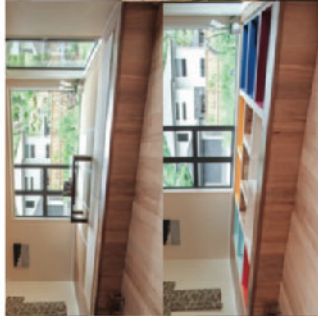
Fig.39 Space-saving Furniture: Storage (Author, 2014)

STORAGE

B Built-in C Compact E Extendable F Folding I Inflatable M Multifunction P Pulling S Stackable



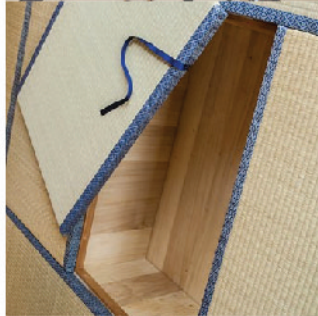
B Floor Storage



B Color Coded Tatami Storage



B Wooden Floor Storage



B Tatami Floor Storage



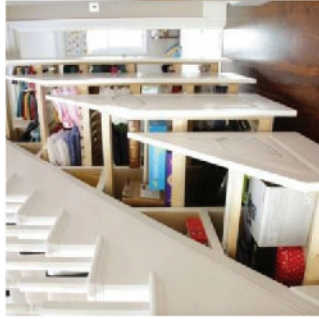
B Trapdoor



B Horigotatsu with Storage



B Shallow Storage



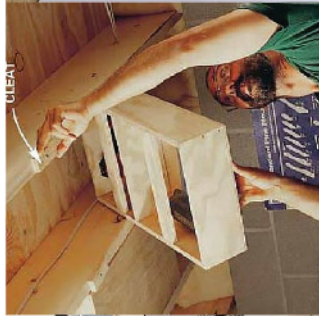
B Stair Storage



B Stair Drawers



B Lounge/Bed Storage



B Ceiling Drawers



B Built-in Ceiling Storage



B Rafter Book Storage



B Slide/Hanging Ceiling Storage



C Walk-in Closet



E Nest Shelf



E REK bookcase



M Flip Spineboard Table



M Pod Pad



M Summer on the Balcony



P Staircase



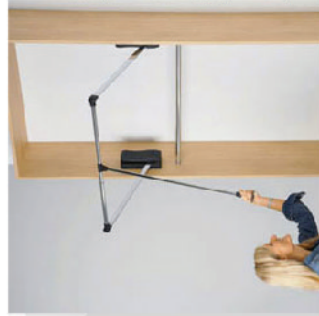
P Tatami Storage with Hinge Lids



P Tatami Storage Module



P Pull Out Wardrobe Rail



P Pull Down Closet Rod



S BrickBox



S Stackable Modules



S Stacking Cabinet "Tree"

17 | SPACE - SAVING FURNITURE

17.1 | STORAGE

17.1|STORAGE

“Experience tells us that the most used items should be stowed in the first position at a level between the waist and eyes; things of secondary importance, or heavy objects should be arranged at a level below the waist; and things that you rarely use should be placed at a level above the eyes.” (F.T.: Robertson, 1996)

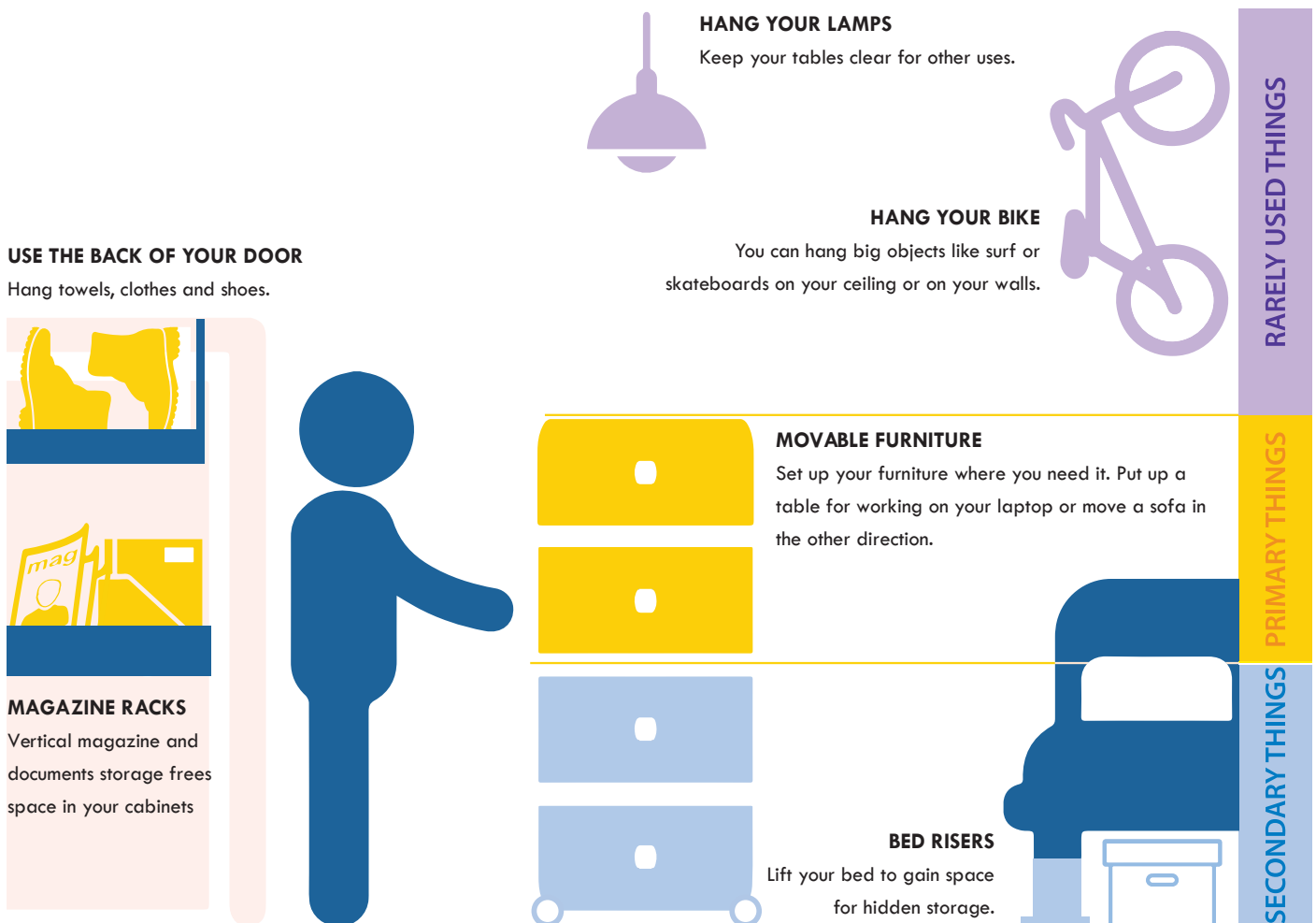


Fig.40 Levels of Organization (Author, 2015)

Furniture occupies permanent space, restricting our movements, activities and needs. By transitioning to floor, wall and stairs, built-in storage we can remove all permanent furniture on the floor and use only light, flexible, folding furniture that we can easily pack. However built-in furniture is expensive and can't be transported to another house, thus it is recommended that instead of being the dweller's investment it should be the contractor's.

17 | SPACE - SAVING FURNITURE

17.1 | STORAGE

“Recessed furniture is permanent and can be expensive, so it’s best to consider how long you want to stay there before you get into a large investment of time and money.” (F.T.: Robertson, 1996)

The lack of storage furniture specialized for different professional needs—such as an artist’s need to store many types of works with different sizes—leaves built-in furniture as the only available option for specific types of storage.

This Israelite 18m² apartment was remodeled to respond to this problem by measuring every print, book, and tool, and by dividing them into categories based on frequency of use. One of the resulting designs was a built-in storage wall with 36 different drawer sizes.



Fig.41 Custom-made wall storage for artist²⁹

Floor storage has been present in the Western culture in the form of a trapdoor, which remotes to even the Egyptian culture, as it was mainly used to hide treasures and not actually store belongings. But in Japan floor storage has been integrated in *tatami* floors. It can be either built-in or bought as *tatami* floor modules. You can combine several modules spread all over the room, to create a room with an elevated floor with storage. The *tatami* mat is optional. One creative built-in *tatami* floor storage used color to organize the different categories of belongings and help remember where things are stored.

The *horigotatsu*, apart from being used for placing the feet while having a *kotatsu* on top, it can also be used like the Western trapdoor. The *kotatsu* can be used as a lid for the *horigotatsu*.

Built-in wall storage is present in built-in closets (with or without doors), and recessed shelves that can also be shallow for small storage. Wall storage isn’t just recessed, it’s also in the form of modules that can be portable like moving walls and wall-mounted panels. Summer on the Balcony is comprised of a series of trays combined with containers that can be attached to a wall-mounted panel. It allows a multitude of configurations to be created and this makes it very versatile and easy to work with.

²⁹ Source: <<http://www.raananstern.com/#!commercial/c11rw>>- accessed 19.06.16

17 | SPACE - SAVING FURNITURE

17.1 | STORAGE

Stair storage can be done from the sides or with front drawers. It's easier to access than floor or ceiling storage, so it is even more important to utilize. Ceiling storage can be done in many ways. Drawers can be pulled down, shelves can be attached to the rafters or hanged from the ceiling, sliders can be attached to the ceiling and hold sliding boxes, or cabinets can extend from the floor to the ceiling. In this case, to access high storage areas stairs can be used, or pull-down wardrobe rails can be added to help pull down clothing.

One easy way to add storage space in a home is by integrating storage compartments in the already indispensable furniture like the bed, the sofa/lounge and the table. The "Pod Pad" is a creative example of a storage cupboard that can have a mini stand and a phone charging station.

Portable storage can be convenient to transfer belongings from room to room or house to house. A compact Walk-in-closet, an extensible bookshelf and stackable storage boxes are some of the portable storage solutions available. Stacking objects, shelves or boxes, can be very flexible because they, don't require screws, don't require big structures like cabinets, and can be useful for temporary storage. Stackable Modules is a Chinese product sold online for 225\$. It's a storage solution divided in many plastic pieces that can be assembled together in flexible ways. The product is targeted mainly for children's bedrooms, hence the vibrant colors (green, pink, black, blue, red and purple) and the childish designs. It appears to be lightweight and also have a weight capacity limit. The marketing addresses the advantage that it isn't wood and so doesn't have humidity problems.

"Modular furniture has evolved to meet the changing needs of modern life. It combines open and closed elements, and modules with drawers for storage and decoration. The great advantage of this type of furniture is its versatility, because you can always add another module when your finances or space allow you to. You can also take it with you when you leave, which makes it a good investment." (F.T.: Robertson, 1996:21)

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Fig.42 Space-saving Furniture:Tables (Author, 2014)

TABLES

B Built-in C Compact E Extendable F Folding I Inflatable M Multifunction P Pulling S Stackable



B *Hanging Dining Room*



C *Corked*



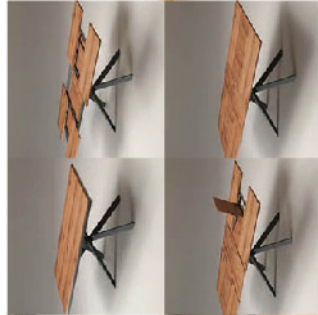
C *Foldaway Office*



E *Goliath*



E *Braun Woodline*



E *Merlin*



E *Fletcher Capstan Table*



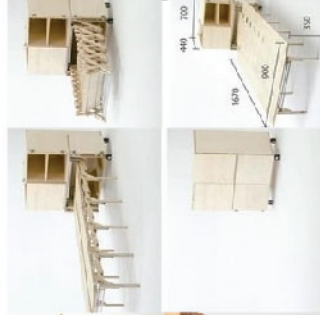
E M *Table for Two*



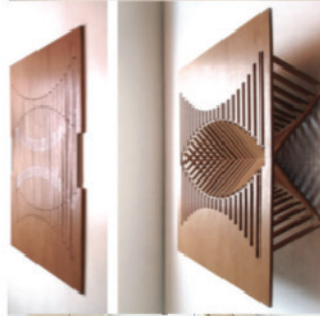
E *MK1 Transforming Coffee Table*



E *Craft 2.0 Table*



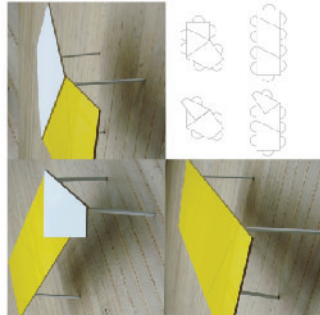
F *Mobile Dining*



F *Rising Table*



F *Grand Central*



F *Unfold Table*



M *Box*



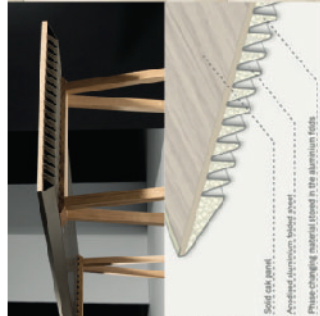
M *Mondial*



M *La Vela*



M *Lacquer Storage Coffee Table*



M *Zero Energy Furniture*



M *Apothem Coffee Table*



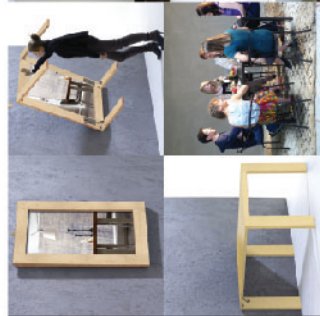
M *Bird Cage Coffee Table*



M *Kai Table*



M *Luce Quadra*



P *Mirror Table*



P *Pulltab*



P *Drawer Table and Bench*



P *Electric Table Horigotatsu*



S *Stackable Tables*

17 | SPACE - SAVING FURNITURE

17.2 | TABLES

17.2|TABLES

One of the most diverse types of furniture are tables. They are used in every room except in the bathroom. Every room depends on a table to be comfortable for use, but in the office the table is absolutely indispensable. The office is the easiest and cheapest room to build in a portable compact box because it's essentially a combination of a table, a chair and a storage compartment.

Tables can be stackable, can be joined together to form bigger tables, can store chairs inside their structure, have storage compartments with light and charging docks, have other purposes like housing birds and they can also warm the room, literally. The Zero Energy Furniture table³⁰ developed by Raphaël Ménard and Jean-Sébastien Lagrange is designed to absorb excess heat when the temperature in the room exceeds 22 degrees Celsius. It also releases the heat back into the space when the temperature drops below 22 degrees. The secret is in the Phase Change Material (PCM) wax located between the wooden surface and the aluminum underside. It melts at 22 degrees, absorbing heat from the surrounding air. As the temperature drops, the wax solidifies and releases the heat back into the room.



Fig.43 Kotatsu³¹

The Japanese have long invented a table with a heater, the *kotatsu*. As mentioned before, a *kotatsu* is a low, wooden table frame covered by a futon, or a heavy blanket, upon which a table top sits. Underneath is a heat source, often built into the table itself. *Kotatsu* tables are used almost exclusively in Japan, although similar devices are used elsewhere. There are two kinds of *kotatsu* used in Japan today, the electric is the modern one. The more traditional type is a table placed over a recessed floor, the *horigotatsu*. The pit is cut into the floor and is about 40 centimeters deep. A charcoal heater is placed somewhere in the pit's floor, walls, or, as in the modern-style *kotatsu*, attached to the table-frame. There are pit-type *kotatsu* with an electric heater too.

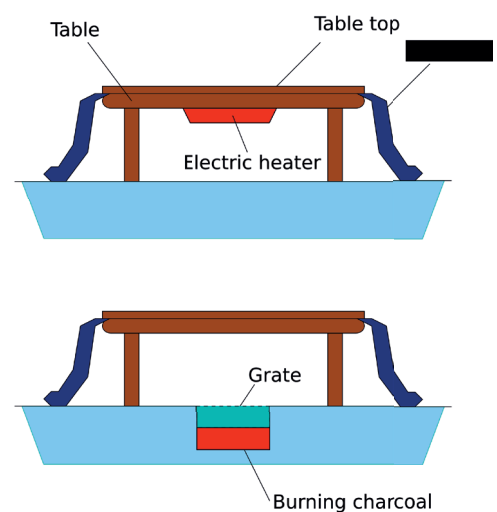


Fig.44 Kotatsu's Heating³²

30 Source: <<http://www.dezeen.com/2015/05/02/zero-energy-furniture-raphael-menard-jean-sebastien-lagrange-stores-heat-regulate-room-temperature-milan-2015/>>- accessed 31.12.14

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17 | SPACE - SAVING FURNITURE

17.2 | TABLES

Heating *kotatsu* tables aren't the only tables used on a *horigotatsu*. In Japan, lots of *horigotatsu* have electric tables that lift from the floor. They are widely used in all sorts of household, commercial, office, leisure venues, cafes, wine, conference tables and computer-display shelves of the product.



Fig.45 Electrical Lifter³²



Fig.46 Electrical *Horigotatsu*³³



Fig.47 Electrical *Horigotatsu*³⁴

Rising tables in the Western culture include bedside or coffee tables whose top can be lifted to the side and be used as trays; and coffee tables with legs that lift in height to become dining tables.

Tables can also be pulled, down from the ceiling from hanging wires; from a bare wall or a wall with a hanging mirror or picture; and from cupboards either by unfolding them or pulling them as drawers.

Apart from rising and pulling tables, one can also extend visible tables and unfold them. Extensible tables are usually small dining or dressing tables that expand to large dining tables, while folding tables are usually flat boards which can unfold to make tables.

33 Source: <http://www.diytrade.com/china/pd/3979111/Motorized_Faders_Bamboo_electric_risers_Electrical_risers.html>- accessed 31.12.14

34 Source: Appendix 4

35 Source: Appendix 4

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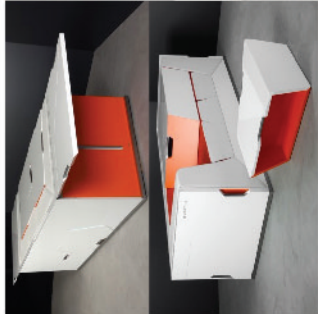
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SEATING

B Built-in C Compact E Extendable F Folding I Inflatable M Multifunction P Pulling S Stackable



C Boxetti Lounge



C Boxetti Practice



C Office



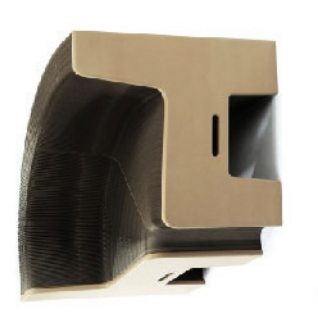
C Olga



E Pull&Push



E Toda



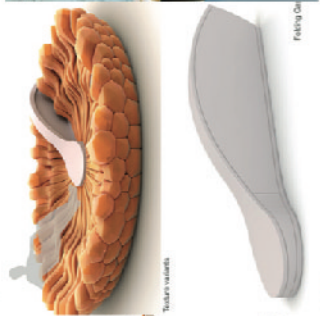
E Flexible Love 8 Seat



F Flux - Envelope Folding Chair



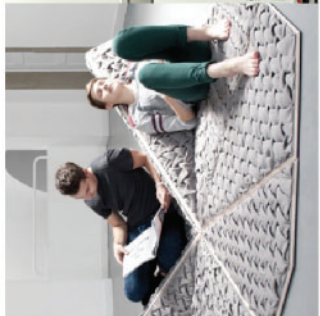
F Dynamic Life



I PicCells



I Blow Sofa



M Sitting Island



M Land Peel



M Flying Carpet



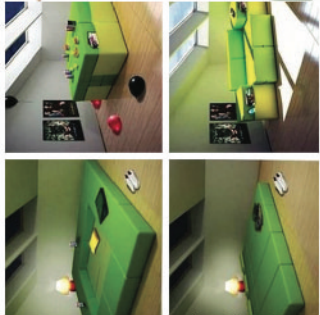
M Panorama



M Thickening Tatami Carpet



M Reclining Chair



M Multiplo



M Sosia



M Convertible Sectional Sofa



M Bada



M The Loop Chair



M Scala Zero



S Cubista



S Cube 6



S Za-isu



S Tatamiza



S Zaisu

17 | SPACE - SAVING FURNITURE

17.3 | SEATING

17.3|SEATING

Seating has been done in chairs in the Western culture but chairs were only implemented in the daily lives of the Japanese with the Westernisation of their rooms. There were, however, also chairs emerging from the traditional floor sitting Japanese customs. These chairs were aimed to the population that had become unaccustomed to sitting on the floor. The *zaisu* is a legless chair that replaces cushions and provides back support, essential for prolonged period positions. *Zaisu* chairs come as of now in many different forms, with sliding bases, foam padded cushions or inflated structures. Other constructions that help with sitting positions may be small triangular blocks that raise the body for a more pleasant *seiza* formal posture; or armrests that can too be helpful for a more comfortable floor sitting. When sitting on the floor it isn't necessary to wear a kimono, but it's beneficial to wear loose clothes, as jeans will constrict the flow of blood creating pain.

The only available information about *zaisu* chairs found by the author is from this decade. *Za-isu*, a *zaisu* designed in 2000 by Noda Furniture, has a seat made from a single sheet of thin plywood. The plywood is folded, much like paper, to make a gently curving and comfortable seat. To support the plywood and provide strength for the structure, there is a metal frame attached to it by two coins. "*Tatamiza*" was designed by Kenya Hara in 2008 to help the designer endure long hours sitting on the floor.



Fig.49 Seiza Compact Chair³⁶

"In a *tatami*-matted study in my house, below the desk there's a sunken area like *horigotatsu* (a sunken space built into the floor with a heat source underneath and a hanging quilt to retain warmth). I sit flat on the floor with my feet in this sunken area. When I sit there working for long hours, a back support becomes crucial. Therefore, I produced an exoskeleton-like chair characterized by its body fitting seating surface and a product presence that's easy on the eye." (Hara, 2008)

Similar to the concept of the Wink chair, the 2014 Reclining Chair from Sanwa Direct doesn't need an internal structure to recline in its 14 stages of angle adjustments. The memory foam (low-rebound urethane with elasticity) and the microfiber surface are the only materials used in this chair and for that reason it is also very light, weighting only 9 kg. *Zaisu* from Tata Chairs is a 2014 model of the classic Japanese design



Fig.50 Wink Chair³⁷

36 Source: <<http://www.ebay.com/itm/Japanese-SEIZA-Compact-Chair-SAMURAI-WABISABI-Navy-from-Japan-/281220584724>>- accessed 31.12.14

37 Source: <http://cdn.cassina.com/sites/cassina.com/files/styles/scheda_prodotto_top/public/content/catalogo/111_wink/immagini/wink_still_life_01.jpg?itok=-NH980oo>- accessed 31.12.14

17 | SPACE - SAVING FURNITURE

17.3 | SEATING

of the *zaisu* chair. It provides back support while sitting on the floor. It's publicized to be convenient for playing video games or watching television, in other words, it's convenient for long time floor-sitting. It's portable and light and conquering the Western culture as well. It's made from high pressed beech plywood and has a cushion for more comfort. Between the many versions of commercial *zaisu* chairs, they can come with or without cushions and sometimes with a 360° swivel in the base.

As of 2014 there are various Internet shopping platforms with access to both the Western and Oriental industry. More than ever before, low floored chairs are available to a universal community. The centuries old Japanese tradition of floor-level living and sitting survived through wars, Western influences and there is still today population that prefers sitting on the floor level. Never before has there been such a mass production of *zaisu* chairs and all-of-a-kind floor sitting chairs. From traditional shaped *zaisu* chairs, to foam based chairs, to even small pieces to help with the *seiza* position, there is everything with the possibility to go everywhere and perpetuate through more centuries of the human culture.

Sitting on the floor, without using a *zaisu*, has been the target of many design products both in the Western and Eastern world. These designs are essentially carpets with many sitting/lying positions. Land peel./Tatami 2.0 was developed by Shin Yamashita in 2010 and consists of three flat pieces that by lifting can become chairs and tables. You can watch TV, talk with your friends, study or read a book. It creates furniture only when necessary and creates a soft floor like *tatami*. The Flying Carpet made in 2002 is a carpet that resembles a garden because it has upholstered wedges that make it a comfortable and playful three-dimensional space.

Panorama was conceived as a carpet with built-in backrests, that can the living room's chairs and sofas, in addition to exercise equipment. Lamps, file cabinets, and tables are also included. One of the backrests can be used for sit-ups, and has an adjustable height for increased resistance. Another lateral element allows the practice of many different fitness exercises, like push-ups or strengthening.

Other floor sitting furniture can be assembled together, like the Multiplo modular pieces. This versatile furniture can be your floor bed or carpet, table, sitting room and anything else you want to build. Sosia and Dynamic Life can have many combinations for sofa and bed positions while the Loop Chair has many combinations for chair positions. Chairs until now have been the most common furniture to double as stairs while sofas are the most common furniture to double as a bed. Bada is instead an uncommon sofa that doubles as a table.

17 | SPACE - SAVING FURNITURE

17.3 | SEATING

Stackable chairs are commonly used for entertaining guests, customers or audiences. Along with folding chairs, they are the easiest crowd-seating furniture to store. Cubista and Cube 6 are two examples of stacking chairs that store inside themselves. Aimed for use at home, when not needed, they are used as one table or bench and, when needed, they multiply into six benches.

Also only used when needed are the inflatable sofas PicCells and Blow Sofa, the extendable chairs Pull&Push, Toda and Flexible Love 8 Seat and the compact furniture Olga, Office and the Boxetti compact modules for living-room seating Boxetti Practice and Boxetti Lounge.

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Fig.51 Space-saving Furniture: Sleeping (Author, 2014)

SLEEPING

B Built-in C Compact E Extendable F Folding I Inflatable M Multifunction P Pulling S Stackable



C Foldaway Guest Room



F The Concealed Bed



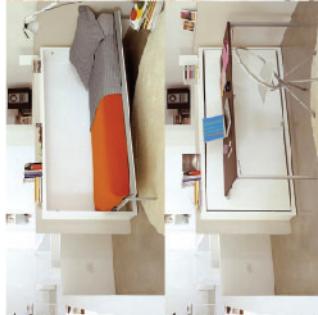
M LGM



M Nuovoliola



M Ulisse Bed



M Poppi Desk



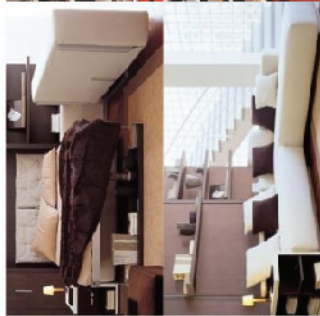
M Ulisse Dining



M WorkBed



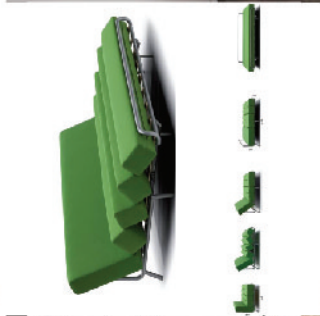
M Palazzo



M Atoll



M Circe Sofa



M Slash



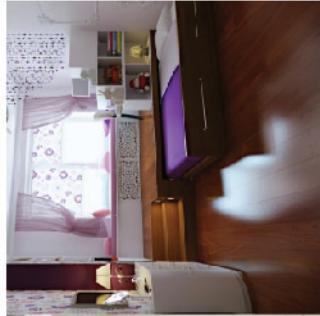
M Storage Bed



P Kali Duo Sofa



P Lift Bed



P Drawer Bed



P Boxetti Private



S Guest Bed



M Modos



C M The Living Cube



C F M Springtime



F M Sweet Talk and Dream



C F M P Story



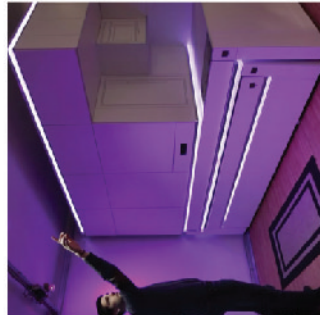
C F M Convertible Sofa



C M 3MOODS



C M P Matroshka



C E F M P City Home

17 | SPACE - SAVING FURNITURE

17.4 | SLEEPING

17.4|SLEEPING

The Murphy Bed is the most well known piece of convertible furniture as it has the ability of transforming any room into a bedroom in 35 seconds.

“Pioneering in the field of motion furniture was William L. Murphy, who in 1900 secured the patent for the famous Murphy bed. Murphy was born in Stockton, California, in the late 1870s, and moved to a one-room apartment in San Francisco as a young man. He wished to be able to entertain guests in this apartment, but had no space. Noting that a significant amount of his available floor space was taken up by his bed, Murphy began work on prototypes for a bed that would fold away when not in use. The successful model was a door bed, with a spring-operated counterbalancing design to prevent unintended folding of sleepers into walls. This was christened the Murphy door bed, and a company by that same name was created shortly thereafter.” (Cole, Browning, Shroeder, 2003)

A century later, after the Murphy Bed went through a lot of transformation, becoming more comfortable and easy to lift, its demand increased again as Americans are building smaller homes and making fewer changes to their existing houses.



Fig.52 Monthly Savings with a Murphy bed³⁸

38 Source: <<http://www.murphybedhq.com/blog/>>- accessed 19.04.16

17 | SPACE - SAVING FURNITURE

17.4 | SLEEPING

“Design features have come a long way, too, transforming the beds into pieces of furniture that can either seamlessly fit into your existing décor or double as a dining table, desk or sofa. While the starting price for a Clei Murphy bed is \$5 000, top-of-the-line features like a feather down mattress, and leather and wood finishings, can bring the price point up to a whopping \$18,000. Apparently that hasn’t deterred sales, which Butterly says have doubled every year since 2011.” (Racco, 2015)

Murphy Beds are nowadays available as part of big living-room cabinets instead of being sold as a separate box. They can fold or rotate to reveal: bookshelves, one shelf, a work desk, a dining table or nothing. There are Murphy beds that, instead of being part of a living-room cabinet, are a bedroom module and there are also double Murphy Beds (bunk folding beds).

This attractive space-saving bed—which replaces the need for an additional bedroom—has been the target of a DIY trend, because people wanted the bed but at a cheaper price. The Murphy Beds in the market are very expensive and that encourages customers to take matters into their own hands.

Other hiding beds include turn around beds that can be used as tables, compact bedrooms, floor drawer beds, beds that lift up to the ceiling, stackable beds, and folding beds like the “Concealed Bed”. Unlike a wall bed, sofa bed or fold down bed, the Concealed Bed is operated at the touch of a button, meaning no more heavy lifting. A concealed bed not only provides a comfortable new sleeping area but can actually improve an office or living room with a wide variety of shelving options available providing you with more storage space.

However, the most common multifunctional beds are storage beds. Either with drawers or by lifting the mattress, integrated storage compartments under the bed are always useful and also easier to handle than storage containers.

17.5 | ALL IN ONE

What’s even more impressive than a sofa that turns into a table, and a bed that turns into a bookshelf, is furniture that can do all of this combined. The most basic way to build multifunctional furniture is by attaching modular pieces together by connectors. This is what happens with Modos which in addition to being long-lasting, is also a relatively cheap option. Modos can become a bookshelf, a table, a chair and anything else. Next, comes compact but still unchangeable structures like The Living Cube, which combines functions like media unit, bookshelf, closet storage, workspace, minibar, multipurpose

17 | SPACE - SAVING FURNITURE

17.4 | SLEEPING

drawers, bike and skateboard mounts, queen-size bed loft and an interior room. It's a good solution for those who need to constantly use all of those functions, however, there are more compressed options that provide multiple functions, although it must be one at a time. This is the case of Springtime, a foldable picnic basket that can be transported on a bicycle and that holds a table for two, chairs and storage space for plates, cups and cutlery. Also a foldable unit is Sweet Talk and Dreams and Story, both have the ability to transform from a seating unit to a lounger or bed while also accommodating a small table. The same can be done with the 3MOODS or Convertible Sofa which is a sofa that can be easily converted into a small dining-table with six padded stools.

"Why so much furniture at home, if you could have it all in one? With 3MOODS your house breathes, cleans better, even looks bigger because do not subtract space and has several functions in only one furniture." (3MOODS, 2014)

Now regarding to larger scale all-in-one convertible furniture there is Matroshka and City Home.

"Matroshka takes a brand new approach to combining the functions of a home. When the basic idea was being conceived, the focus was on seeing the room as a volume instead of an area, and on creating plenty of storage while also keeping the furniture comfortable and appealing. The result was the concept of 'four rooms in one', where the living room, bedroom, study and dining room are all neatly compacted into 15m². The raised study area has been a real hit with our stakeholders, who like the idea of 'going up to work' and then being able to leave your work there. This has a positive psychological effect, making it easier to draw a line between work and leisure. The L-shaped desk is fantastically spacious, with a standard height and depth. You may be living in a small space, but that's no reason to use small furniture.

A common problem in small residences is having guests round and finding somewhere for them to sit. With Matroshka, the solution is easy as the living room set-up has space for up to 12 people around the table. The table itself, which is sold separately, can be moved up and down hydraulically, making it simple to adjust to your needs at a particular time – one moment it's a dining table, the next it's a coffee table. And on top of all that, you also get a double bed and generously proportioned storage spaces." (Matroshka, 2011)

"MIT CityHome is a gesture-controlled house within a box. It is literally an entire apartment packed into a mechanical box that is roughly the size of a closet. The box houses a bed, dining table, kitchen surface, cooking range, closet, and storage spaces. Any of these domestic components can be accessed via gesture, touch or voice control. According to its creators, the CityHome is designed to make any tiny apartment space more livable." (Angue, 2015)

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Fig.53 Space-saving Furniture: Entertainment + Bathroom/Laundry (Author, 2014)

ENTERTAINMENT

B Built-in C Compact E Extendable F Folding I Inflatable M Multifunction P Pulling S Stackable



C Bocetti Thrill



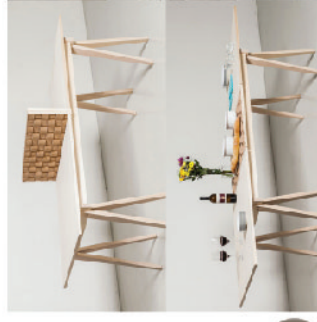
M Pianotable



M PingPongDoor



M Boxing Couch



M Flëtta



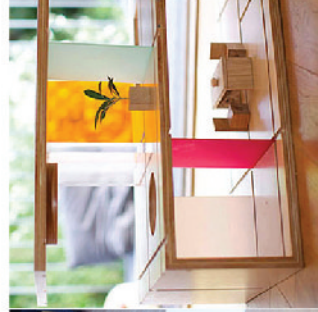
M Brookstone Pillow Remote



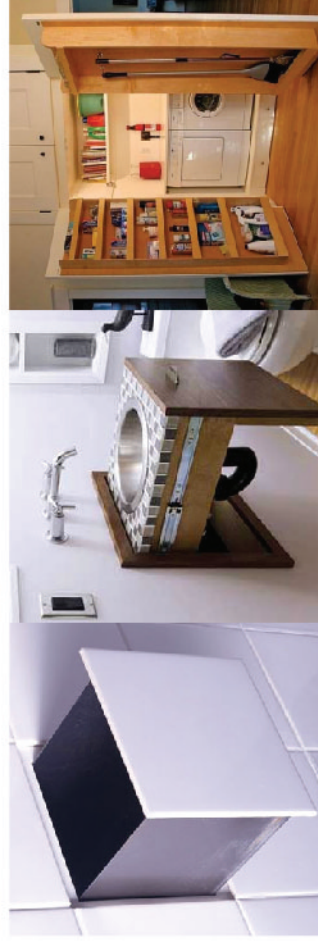
M Fusion Table



M Flap Table Dining/Pool Table



M Coffee Table/Dolls House



B Sink in a Drawer



B Washer Cabinet



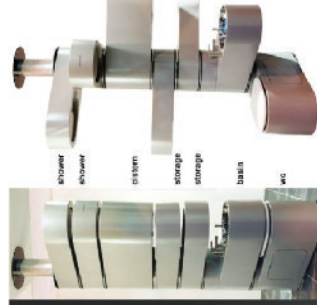
B Bathroom Closet



C Toilet/Sink (W+W)



C Washing Machine with Sink



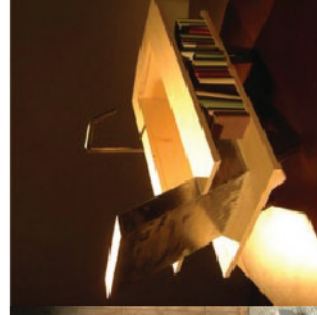
C Vertebrae



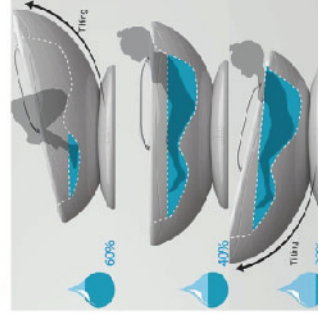
F Hidden Washer



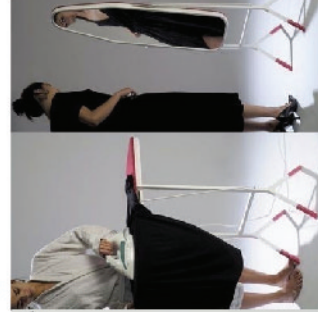
F Folding Shower



M Library Bath



M Multifunction Bathhub



M Madame est Servie



M Iron Table Mounted on Wall



P Hidden Clothesline



P Bathsmart Stowaway

17 | SPACE - SAVING FURNITURE

17.6 | ENTERTAINMENT

17.6|ENTERTAINMENT

A new kind of furniture emerged as a result of the convertible trend: furniture combined with music, playing and exercise equipment. These interesting examples provide the possibility of having big apparatuses like a piano, a sound system, a Ping-Pong table, a Pool table or a punching bag, without taking up the same additional space. Also smart, is the combination of small entertainment products, like a remote control or a children's doll house, to other useful furnishings like a pillow or a coffee table.

17.7|BATHROOM/LAUNDRY

Combined bathroom furniture is most known for the Toilet with Sink product, a very space-saving solution for small bathrooms, but lately other concepts for small bathrooms have been surfacing. The most compact concept is a bathroom "tower" that has two shower heads, a cistern, two storage compartments, a basin and a toilet. When it comes to taking a bath, there's the folding shower, and the multifunctioning bathtubs. These bathtubs are either rotatable in three positions to save water and allow for different bathing experiences; bathtubs can also have integrated bookshelves, storage compartments inside. Storage in the bathroom is usually done with a bathroom closet, but the "Function Tiles" can provide storage inside the bathroom walls, without taking up any more space.

The laundry room, if there is one, usually has little storage space, so a good idea is having the laundry room inside a built-in wardrobe and add hanging shelves on the doors for storage. Apart from maximizing storage space it also hides the laundry equipment. Hiding laundry equipment is actually also a trend. One can hide the washer under a kitchen counter, or hide the ironing table behind a standing mirror or a wall mirror, and use expandable clotheslines to hide them when not in use, while also saving space with such a compact solution. Similarly, to the bathroom, the laundry room can also have a washing machine with an integrated sink.

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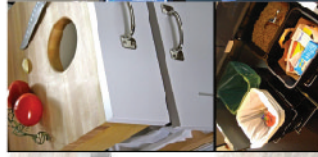
Fig.54 Space-saving Furniture: Kitchen (Author, 2014)

KITCHEN

B Built-in C Compact E Extendable F Folding I Inflatable M Multifunction P Pulling S Stackable



B Hidden Rubbish Bin



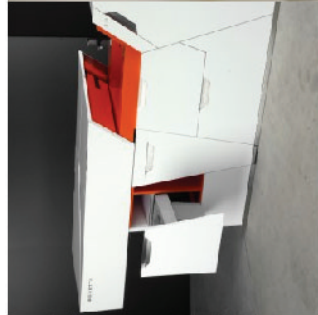
C The Island Kitchen



C Rotating Kitchen



C Boretti Lunch



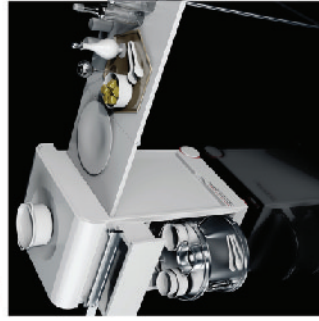
C Mobile Kitchen



C Gali



C Kitchen Drawer



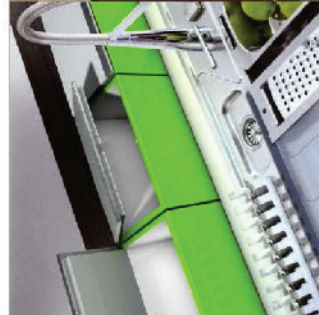
C Moving Kitchen



C Portable Induction Cooktop



C X-Pot



C "Neff" Portable Fridge



C Double Drawer Fridge



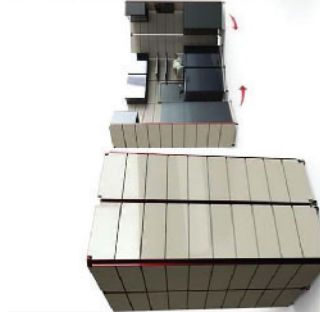
C Double Drawer Dishwasher



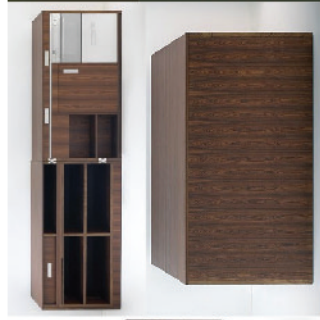
F Folding Island Kitchen Buddy



F Pop Up Kitchen



F Foldable Kitchen



F Portable Kitchen



F Virtue Modern Kitchen



F Foldable Kitchen Accessories



M Maisonnette



M Electrolux Futuristic Dining



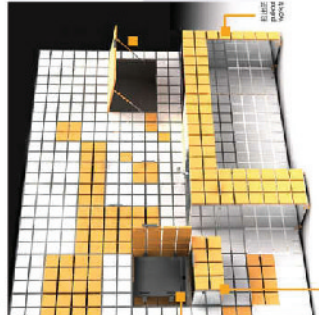
M Enclosed Kitchen Sink



M Sink Stove Combo



M Plug and Play Fridge



P Tetris Kitchen



P The Crates



P Dog Bowl Drawer



S Modular Fridge

17 | SPACE - SAVING FURNITURE

17.8 | KITCHEN

17.8|KITCHEN

The kitchen is a very prominent room for accessory innovation. Easy improvements in the kitchen can be done by having rubbish bins built into the counter, or by hiding things that occupy space, like dog bowls, by building them into drawers. Practical additions to the kitchen can help to save or add temporary space. Compact cooking pots or foldable kitchen accessories can save a lot of space in the cabinets. Folding trolley tables or multifunctional trays are used to carry multiple things around the house. An enclosed kitchen sink adds a lot of counter work area while also hiding the kitchen sinks.

Product design has a strong interest in the kitchen because it's the room with more appliances in the house, and they normally aren't used simultaneously. As a result, compact kitchens are a trend in design as they become more and more appealing to the small kitchen and small house progression.

"The Electrolux Design Lab is a global design competition open to undergraduate and graduate design students who are invited to present innovative ideas for future households. In previous years, concepts have been requested for healthy eating, sustainable living, the internet generation and ever-shrinking city spaces for example. In response, young students have submitted designs such as Flatshare, a stackable refrigerator for roommates, Cocoon, a meat and fish maker, and Snail, a portable induction heating concept. The brief for 2015 calls for innovative ideas for Healthy Happy Kids under three focus areas; Cooking, Fabric Care and Air Purifying." (Electrolux, 2015)

The smallest type of compact kitchen is the portable which exists in the form of a filing cabinet. It may be able to slip under your office desk or even be taken outside the house. It may even be folded shut into a box. It can have drawers that may contain a counter, an electric stove, a dish drawer, a mini fridge, a folded table and storage space.

Bigger compact kitchens aren't usually portable. They are tall and can be rotatable, folded or pulled whenever necessary. They have energy-saving systems, thanks to the close proximity and interaction of appliances with each other, and also exchange heat and moisture. All of the electrical elements are powered by the energy produced by solar panels. Even small vertical gardens can be added to these compact kitchens. The water coming from the sink is filtered and reused in the dishwasher; then undergoes a

17 | SPACE - SAVING FURNITURE

17.8 | KITCHEN

second filtering process and is used to water the plants in the vertical greenhouse. The air treatment is based on nanomaterials of titanium dioxide that are able to purify the air in a medium-sized room in a few hours.

But compact kitchens aren't always tall. An Electrolux design entry consists of a compact kitchen in the form of a dining table.

"Once you sit down, you needn't get up to make a toast or fetch the coffee, get an apple from the fridge or even wash your dishes. It's all integrated into the table. The appliances integrated include a mini-dishwasher, toaster, coffee machine, boiling kettle, cold water dispenser, a freezer, mini-microwave and cutlery holder. The top layer of the table is a touch display screen, allowing access to the internet. It displays daily press (newspaper, magazines), allows search for recipes and enables communications." (Seth, 2009)

Compact appliances are more affordable than an entire compact kitchen and that's why they are already on the market. They come as portable one-plate induction cooktops; portable fridges that harvest the leftover energy from the kitchen; modular fridges that can be stacked on top of each other and provide private individual use; plug and play fridges with gadget docks or water filters; sink and stove combos; and double drawer fridges or dishwashers.

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Fig.55 Space-saving Furniture: Homes (Author, 2014)



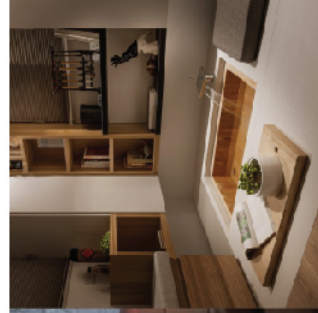
25 **1** **Barcelona, SPAIN**

Bed with pull out-closets from underneath.
Dinner table that slides to reveal a bench with a zaisu on top, which also slides to reveal a bathtub.



70 **3** **Barcelona, SPAIN**

Floor storage (lifted with a suction cup).
Central cube with bathroom, kitchen and storage.
Minidisk washer. Walk-in shower.
Tatami floor in bedroom.



26 **3** **Taipei, TAIWAN**

Modular cushions to form sofa, study bench, guest bed. Folding doors to hide work nook.
Horigatatsu with shower, hidden when unused.
Staircase inside kitchen wall, pull it out to use second floor bedroom. Ceiling and floor storage.



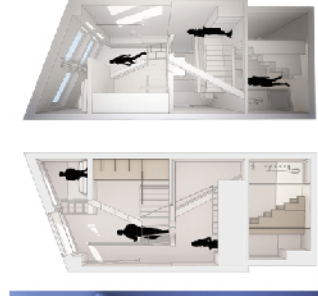
50 **2** **Viana do Castelo, PORTUGAL**

Second floor bedroom.
Pull out storage shelf from wood wall panel.
Stair storage.
Wall storage.
Bedroom wall divider.



44 **2** **Matosinhos, PORTUGAL**

Movable wall with storage.
Automatic pulling drawers.
Audiovisual connectivity with TV, lightning, etc.



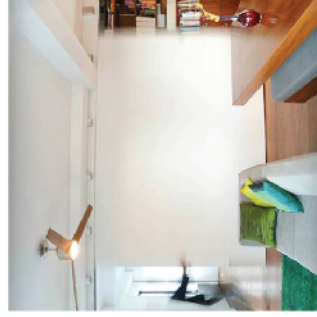
25 **2** **Paris, FRANCE**

Metal structure that would act as staircase/-
Floor/ceiling to let light inside.
Stair storage.



57 **2** **Madrid, SPAIN**

Ceiling storage.
Floor storage and mirror.
Hanging dinner table and benches.
Hanging hammock and swing.
Foldable counter space in kitchen.



51 **2** **New York, U.S.A.**

Sliding door/wall hung from the ceiling.
Everything is hidden, electric panel is hidden behind a door.
Dinner table with drawers, network connections, and electrical height adjustable (can be used as kitchen counter). Murphy bed.



41 **1** **Manhattan, U.S.A.**

Murphy bed.
Room divider/closet door/ desk.
Multifunctional wall with ceiling light.
Cabinet door with holes to pass cables.
Small cabinet refrigerator.



9 **1** **Porto, PORTUGAL**

A large-scale modular furniture piece with integrated kitchen, storage, seating, bed and a bathroom.



27 **2** **Barcelona, SPAIN**

Apartment is empty, everything is inside boxes.
By adding steps, no space is wasted, everything is hidden underneath.
2 Pull out beds with storage on top of them.
Foldable kitchen. Foldable dinner table.



8 **1** **Paris, FRANCE**

Sliding staircase with storage.
Pull out wardrobe, dining table with hanging chairs, storage shelves.
Kitchen sink cover.
Walk in shower.



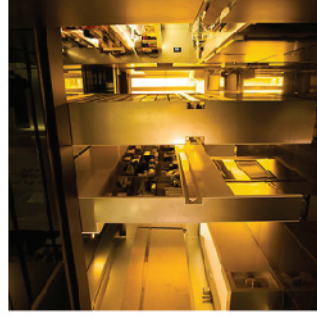
24 **1** **Barcelona, SPAIN**

Top to bottom storage wall hiding kitchen.
Pullout bed from under balcony/ chair/ sofa.
Hidden storage inside wall of shower.



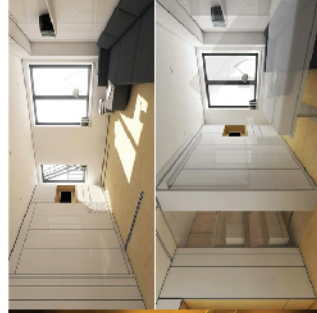
50 **2** **Madrid, SPAIN**

Sliding walls with 2 Dinner tables + storage /
Work-client space with chalkboard;
Work Storage / Bed + bedroom storage;
Closet / Bathroom storage.



30 **1** **Hong Kong, CHINA**

Sliding walls: book case/Storage (linen closet?)/
Soaker bathtub + pull down guest bed;
TV/kitchen counter and storage/pull down bed/sofa;
Screening room with a hammock.



39 **4** **New York, U.S.A.**

Murphy sofa/bed; Murphy bunk bed; Galloch table; Moving wall; Bicycle storage; Magnetic curtains; Toilet/seat; 1 burner stove (3 pieces); small dishwasher, freezer and fridge; Electronic composter; Shoe storage on entrance (genkan).



11 **1** **Seoul, SOUTH KOREA**

Murphy bed; Pull out counter; Projected screen. One unit can be opened and combined with another. Exhibition spaces, basement, and second floors are a shared living room.



48 **3** **San Francisco, U.S.A.**

Energy recovering ventilating unit inside a bench
Laminated glass, soundproofing and sun reflection; Drawer bread board; Eurodath (incorporated shower in the bathroom); Smart bench/table/ bed (height adjustable).



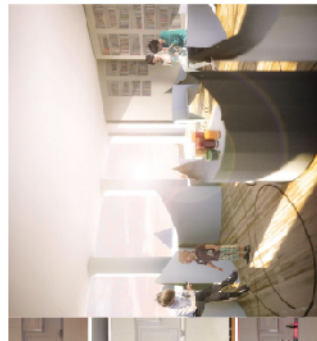
24 **1** **Brooklyn, U.S.A.**

Murphy sofa/bed;
Kitchen counter unfolding;
Dining table foldable and hanged on wall when unused;
Ceiling storage;



18 **1** **Massachusetts, U.S.A.**

Furniture, light and music moves automatically by using hand gestures and voice captured by cameras. Pull out bed, desk, dining table, benches. Automatic Moving walls to increase bathroom space when needed.



50 **2** **Delft, NETHERLANDS**

Kitchen, bathroom, living room, an office, a bar, storage, and two bedrooms, with room to spare. Driven by sub-floor motors. When activated, flat panels slide from their hiding place, changing shape as they move to their temporary position.

17 | SPACE - SAVING FURNITURE

17.9 | SPACE - SAVING HOMES

Multifunctioning furniture can be helpful to improve a current home, but built-in furniture and innovative home layouts have an even bigger impact on space-saving and multifunctioning. The following collection gathers a few interesting examples of micro homes and flexible houses around the world.

Beginning with small modifications comes the Barcelona 25m² one-room apartment that has two interesting structures: a raised bed placed on top of a low and wide closet with pull out drawers; and a sliding dining table with an also sliding bench, with *zaisu* chairs on top to help for back support, and a bathtub underneath.

Next is a Barcelona 70m² apartment that was remodeled to centralize in one block: the bathroom (with a walk-in shower), the kitchen (with a mini dishwasher) and the closet. On the opposite sides of the apartment is the living room and the *tatami* floored bedroom. This apartment also has built-in floor storage that is accessible with the use of a suction cup to raise the floor.

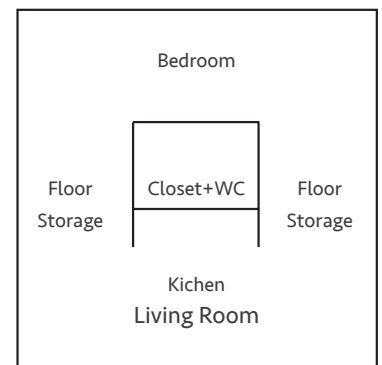


Fig.56 Barcelona 70m² layout (Author, 2016)

Keeping up with the Japanese trend is also a Taipei 26m² apartment that has a living-room *horigotatsu* with an integrated shower for a so-called “meditation shower”. This *horigotatsu* has a lid to cover it when not in use. In the living room there’s also a wall bench with modular cushions that can be arranged to make it a sofa, a study bench or a bed. Storage can be hidden under the floor or on the ceiling, or even behind walls. There’s a wall work-nook hidden by a sliding wall. Another wall also hides the kitchen with a pull-out staircase that is also hidden when not in use. This staircase takes us to the second floor bedroom.

The Viana do Castelo 50m² house also has basic modifications like wall storage, stair storage, and a second-floor bedroom with a wall partition. Another Portuguese flexible house is the 2010 ArchDaily “Building of the Year”. Innovative at the time, the Closet House in Matosinhos has a movable wall, with storage, that hides the bedroom, automatic pulling drawers and an audiovisual system that connects the TV, the lightning and the energy system.

The Parisian three story 25m² apartment has stair storage and a thin metal structure that allows light to flow to the three stories, and acts as a staircase, floor and ceiling. And the Madrid 57m² apartment has an interesting approach to built-in storage, ceiling and floor

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storage. The ceiling furniture included a hanging dinner table with benches, a hanging hammock, and a swing. The floor storage included a floor mirror.

Now to New York City, the 51m² converted apartment decided to hide the most possible amount of things. It has a Murphy bed, and every wall is a cabinet, even the bathroom tile walls are closets with push latches, and everything is hidden, even the electric panel is hidden behind a small door. The closet rods can slide for easy access, the furniture is on wheels to be easily moved around, and the modular sofa even has storage drawers. It has a sliding wall hung from the ceiling, that either separates the bedroom from the living-room, or enlarges the living room. This sliding wall has built-in storage that is hidden when the wall is pulled back. The dining table is also an impressive piece with drawers. It's plugged to the electricity to have network connections and electric height adjustment to double as a kitchen counter area.

Apart from built-in storage, it's also possible to add big volumes of hidden storage to improve the flexibility of an existing house. This is what happens in this Manhattan 41m² apartment which has a big furniture piece with a Murphy Bed, that also functions as a room divider, a closet door or a desk with a holed cabinet door that allows cables to pass through. This multifunctioning wall even has integrated ceiling lightning. Another conversion in this apartment was done in the kitchen where a small cabinet refrigerator was installed.

Another example of adding big volume furniture to a room is done in Porto, Portugal. There they developed a 9m² large-scale modular furniture piece with an integrated kitchen, storage, seating, bed and bathroom. The 27m² Barcelona empty apartment was also furnished with smart boxes. The boxes contained a foldable kitchen, a foldable dinner table, two pull-out beds with storage on top of them, and by adding steps it was possible to hide a bed underneath a floor box.

More complex apartment remodeling can allow for different room uses and layouts. This 8m² Parisian apartment, that was actually an old maid room, was converted into a full equipped apartment. The conversion of old maid rooms into apartments or studios is common in Paris, but not always legal³⁹. This one had a sliding staircase with storage, that led to a second floor bed. It also had a pull out wardrobe, a dining table with hanging chairs and storage shelves. The kitchen sink had a lid cover and the bathroom had a walk-in shower.

39 Characteristics of Decent Housing in Paris (Decree No. 2002-120 of 30 January 2002): the accommodation must comprise a livable floor area of no less than 9 square meters above which a ceiling height of at least 2.20 meters, or otherwise a living space of at least 20 cubic meters. The accommodation must be equipped with heating, electric and gas installations that comply with safety regulations. If the property consists of only one room, its sanitary facility may be limited to a WC located outside the flat.

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This Barcelona 24m² apartment is also a one room apartment fully equipped with a bedroom, dining room, kitchen and bathroom. It has top to bottom built-in wall storage that hides the kitchen and the wardrobe. The bathroom wall also has built-in storage. The bed is hidden under the exterior balcony, and pulled inside the apartment only when needed.

Built-in wall storage is great for very small spaces, but bigger rooms can have an interesting layout with the use of moving walls. This allows for the use of different rooms at the same time and has the advantage of providing fluctuating room sizes between the bedroom, the office, the kitchen and the bathroom. There are many examples of apartments with moving walls. This selection will present the three best examples found of remodeled apartments and two examples of brand new micro homes.

The easiest but still impressive result of adding moving walls can be seen in the 50m² Madrid house. The sliding walls are hanged from the ceiling because it's easier to slide this amount of weight from the ceiling than if it were rested on the floor. They are made of OSB wood, a cheap but rough surface made from wood strands. While the kitchen and the bathroom are on the opposite sides of these walls, in between them there are three sliding walls that work as: two dinner tables with storage on one side, and a chalkboard for the office on the other; a office storage cabinet on one side and a Murphy bed with bedroom storage on the other; and a wardrobe on one side and bathroom storage on the other.

A little more complex is the sliding wall system of this Hong Kong 30m² apartment. The sliding walls reveal a book case, a wardrobe, a soaker bathtub, a pull down guest bed, the TV and kitchen counter and storage and a Murphy sofa/bed. It also has a hanging hammock and a screening room. The wall tracks are on the ceiling and the floor and to hide the ceiling tracks, the ceiling is filled with mirrors that make the tracks less conspicuous and also reflects light around the apartment.

The more elaborate and best achieved remodeling of an apartment with moving walls is by far the Soho, New York 39m² apartment funded by Graham Hill, the founder of LifeEdited. This small apartment has so many functions it's almost unbelievable that four people can live inside.

- The entrance hall has shoe storage that works like the Japanese genkan. On one outer wall it has a Murphy bed/sofa; a reading light and an electric plug hooked to an external solar panel; a heat recovery ventilator that filters the air; wardrobe storage; and LED dimmable lights.

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- On the sliding wall it has a pull-out desk with underneath storage and a computer; an adjustable height seat; storage in both sides; and a movie screen panel with a projector.
- On the opposite outer wall there's a bunk Murphy bed and bicycle storage. To provide visual and acoustic privacy to this guest bedroom, there are sliding curtains hanged from magnets to a piece of steel in the ceiling.
- In the dining/living/bedroom there's a Goliath table (fit for 2-10 people) and stackable chairs. In the bathroom the toilet can be converted into a seat for private phone calls. In this minuscule compartment there is also built-in storage in the walls.
- The kitchen has compact kitchen tools; "sporks" that replace forks and spoons; one multiuse plate for soup/salad/entrees; three portable one-burner electrical stoves; a 2-gallon top-loader dishwasher (instead of normal 6 gallon); a small drawer freezer and a small drawer fridge; an electric composter; a microwave-oven combo; a pull-out shelf for kitchen machinery; and invisible magnetic plant vases attached to the wall.

When it comes to new micro homes, they have the advantage of having been designed from the start. Even though there's freedom to create different different layouts, micro homes aim to be affordable to be able to provide cheap rentals and thus the most basic micro homes don't come with a lot of innovation. This Seoul building of micro homes is one example. Aimed for lodging students, it has 11m² individual rooms with innovations like a Murphy bed, a pull out counter and a projected screen. One interesting choice about this building is that it can open individual units and combine them with others. To help lodgers stretch in bigger rooms, it has common spaces like exhibition rooms, and shared living rooms in the basement and in the second floor.

A similar thing happens in a San Francisco building of micro homes, which has a shared living room and a common work room. The units are also simple with only a few innovations like a variable height table; an energy recovering ventilating unit inside a bench; laminated glass for soundproofing and sun reflection; under bed storage drawers; a standing desk; a drawer bread board; an Eurobath (incorporated shower in the bathroom); and a smart bench/table/bed (height adjustable).

This Brooklyn 24m² micro home is also simple but also unusual. It has a Murphy sofa/bed, an unfolding kitchen counter, a foldable dining table that is hanged on the wall when not needed, and it has ceiling storage for big or long objects like a surfboard.

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Finally, the last two examples of micro units have very innovative technology. This MIT experimental 18m² Massachusetts micro unit has furniture moving automatically by using hand gestures captured by cameras. In this way you can pull out a bed, a desk, a dining table or a bench from a wall. A kitchen wall is also automatically moved and can increase bathroom size. The kitchen also has an unfolding counter top (it seems this is very common in space-saving homes). But not only the furniture is automatized, the lightning is also adjustable with a mobile app or with gestures, and it can alternate between different colors. Music can also be activated by voice.

The last example is the most radical concept for flexible homes. It was developed in Delft and aimed to reach the qualities of a much bigger apartment. In 50m² it can have a kitchen, a bathroom, a living room, an office, a bar, storage and two bedrooms, with room to spare. It consists of folding panels driven by sub-floor motors.

“When activated, flat panels of purpose-cut polypropylene slide from their wall-side hiding place, changing shape as they move to their temporary position. While sliding over rails, the panels are able to pop up into walls, chairs, beds or desk.

Therefore, a high variety of different spatial configurations is possible, creating only the spaces which are needed at a certain time. Bedrooms are not needed during the day, and can be transformed into a working space or large living room. The pop-up apartment allows to live in a continuously changing space, real-time tailored to the wishes of the future user.” (Delft University of Technology, 2014)

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Other examples of flexible, minimalistic homes are:

The Schröder House—currently placed in the UNESCO World Heritage List—was built for Truss Schröder, a widowed mother of three that wanted to “*live in the active sense and not be lived*”. The result of this wish was a central living room with flexible walls that could partition it into different spaces (Central Museum⁴⁰).

Nine Hours is a luxurious minimalistic Japanese hotel in Tokyo that implements the following equation: 1 hour shower + 7 hours to sleep + 1 hour rest = 9 hours. Over nine stories, it has 125 modern capsules with separate male and female quarters, locker rooms, showers and a lounge.

GoSleep is a sleeping pod that rents for 12\$/hour in the Abu Dhabi Airport and will eventually offer electronic gadget charging and internet access.



Fig.57 Schröder House⁴¹



Fig.58 Tokyo Capsule⁴²



Fig.59 GoSleep⁴³



Fig.60 Sleep Box⁴⁴

SLEEPBOX is an eco-friendly new concept for hotels, developed in England for the aviation, travel and hospitality industries. It aims to “re-energize the weary and disenchanted guest by offering them an affordable and convenient solution when they most need it.”

40 Source: <<http://centraalmuseum.nl/en/visit/locations/rietveld-schroder-house/>>- accessed 31.12.14

41 Source: <http://blog.silive.com/homegarden_impact_design/2008/11/design11508.jpg>- accessed 31.12.14

42 Source: <<http://trendland.com/9-hours-capsule-hotel-in-tokyo/>>- accessed 31.12.14

43 Source: <<http://www.gosleep.aero/>>- accessed 31.12.14

44 Source: <<http://www.sleepbox.co.uk/>>- accessed 31.12.14

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Other Space-Saving Homes:

BANGKOK, THAILAND
youtu.be/XnFzDz0FNc8

CHICAGO, USA
www.toyboxtinyhome.com/

COPENHAGEN 65M2
youtu.be/aGhlyBaPPc

COPENHAGEN 62M2
youtu.be/O_BdfZ2lwcA
youtu.be/Rk3he45vuLc

12.000€ HOME, SPAIN
youtu.be/nyWYrfCHEO8

KANAGAWA, JAPAN
youtu.be/h0IYv6u1xYM

KYOTO, JAPAN
faircompanies.com/videos/view/fractal-kyoto-tiny-cube-hut-as-house-insidefice-building/

KYOTO, JAPAN
youtu.be/0itiWgGu1wg

LISBOA, PORTUGAL
archdaily.com/769480/xadrez-apartment-uma-collective

PARIS, 14M2
youtu.be/AxW-tzVmul4

PARIS, FRANCE
youtu.be/vuLJLJZ69zl

POLAND

[tinyhousetalk.com/amazing-139-sq-ft-micro apartment-in-poland/](http://tinyhousetalk.com/amazing-139-sq-ft-micro-apartment-in-poland/)

RHEIN, GERMANY

www.gizmag.com/renzo-piano-micro-home-diogene/27923/

SYDNEY, AUSTRALIA

inhabitat.com/carter-williamsons-at-packed-emergency-shelter-debuts-in-martin-square-in-sydney/

THE FREEDOM ROOM, U.S.A.

[inhabitat.com/the-freedom-room-is-a-low-cost-micro apartment-designed-by-prison-inmates/?newgallery=true](http://inhabitat.com/the-freedom-room-is-a-low-cost-micro-apartment-designed-by-prison-inmates/?newgallery=true)

TREEHOUSES, SWEEDEN

youtu.be/gqt71xsE2Yg

UNIVERSITY OF HERTFORDSHIRE, UNITED KINGDOM
youtu.be/oDzjFEU_gjg

COMPANIES THAT SELL MODULAR

Micro HOMES

youtu.be/p63pojUa8rw

www.hi-kub.com/p/habitacao-temporaria.html

heijmans.nl/en/heijmans-one/

www.escapehomes.us/#!/classic/c195d

tinyhousebuild.com/home-plans/

www.pocketliving.com/homes/gallery

www.soleta.ro/Tech_Details

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- Second Floor Bed

Fig.61 Space-saving Furniture: Layouts (Author, 2014)

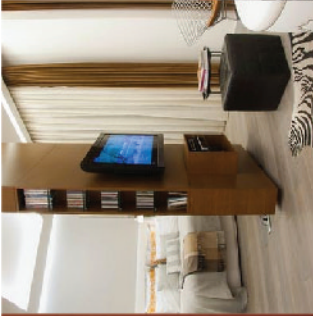
SPACE-*SAVING* LAYOUTS



House Sliding Walls



Office Sliding Walls



Rotating TV Wall



Sliding TV Wall



Bedroom/Office Divider



Wall Sliding along Table



Open Space



Inflatable Walls



Removable Walls



Transparent Sound Barrier



Felt Panels



Moisture, fire and sound absorbent tiles



Paper Walls



Curtain Dividers



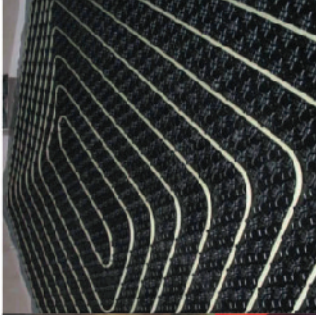
Modular Partitions



Sliding Doors



Integrated Lighting



Integrated Heating



Comfortable Floors



Second Floor Bed



Loft Bed



Corner Sink



Corner Furniture



3D Printed Joinery



3D Printed Furniture



Magnetic Table



Genkan



Robotic Cleaners

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17.10 | SPACE - SAVING LAYOUTS

The following graphic represents a recapitulation of the elements that can help living in a house with a different layout, such as some of the ones seen in the Space-Saving Homes.

Starting with a solution present in some micro homes, Moving/Sliding Walls can be useful for creating large and small spaces easily, to give style to a room, to use as storage or to create furniture. It can be very useful for small houses which require flexibility. It can be used in a home or an office and they can slide or rotate.

Either we choose a house with a spare room that can be a guest room, a home office or a future baby room, or we will probably not be able to let a guest spend the night or find an extra room for your baby. Flexibility in the room according to the changing of needs is very important to ensure that you do everything you wish to. Apart from separating a living room, a bedroom, a kitchen or a bathroom in a house, these walls could be used to separate several bedrooms. When starting a family, one could be relaxed on choosing a house if there were several moving walls that could create new bedrooms along time. When the children grew up and moved out, there would be no more need to maintain their bedrooms at all time, as they would only be used again for occasional guests. The walls could be collapsed together or used to create different-sized rooms for hobbies. These walls can substitute a lot of furniture used for storage, seating, sleeping, working and eating. This makes them easy to collapse and adds flexibility to all the available space. Walls can also be used to rotate an object such as a TV between the bedroom and the living room.

Not only they can slide forward or rotate, they can also be unfolded to serve as a room divider. In the Bedroom/Office divider, the bedroom has a window to the office that is covered by a folding wall. When this wall unfolds, the bedroom is separated in half and the office next-door is enlarged by using the in-between window as a door. Another example of a moving wall, inside this home, can be found in the living room, where the wall has a hole to slide above a long table. This way, it can separate the living room in two, without having to remove the long table, while allowing it to be used on both sides. On top of this table there are sliding ceiling lights that can be pushed back when the moving wall comes forward. These two structures were said to be low cost by the owner, who lives in Tokyo, and used three months of office rental, 7 000£, to build this instead of renting an office.

Open space homes normally have a large room for the kitchen, dining room and living room. But this Open Space example shows a whole new way of opening up the space

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without removing the edges of the rooms. Open spaces can be separated very easily with wall partitions. Inflatable walls are largely used in events to create spaces with privacy and sound isolation for conferences, talks, etc. They are very quickly assembled and very light compared to normal walls. There are many layouts available and many companies that specialize in renting them.

Removable wall panels can be handled by one or two people. They are usually installed through floor and ceiling rails. These panels provide the ability to move all of the internal walls, and may also provide a better sound shield than Japanese paper panels. If we think back to the traditional Japanese architecture, we can find some similarities. On the one hand the divisions made by paper panels (*shoji*), opened and closed easily the rooms of the house. On the other hand, the size of the houses also relied on the floor length size. The size of the houses was defined by the amount of *tatami* mats that could cover its floors. The exterior walls also consisted of panels that opened completely and expanded the space of the house to be able to join the garden.

The MIMA House was developed by the MIMA LAB—a multidisciplinary studio in Porto, northern Portugal, and primarily consists of light removable panels. If we look at the economic and social context in which architecture is, we see that currently the slower work of a single person is undervalued and expensive. Thus, architects had to learn to work with the industry, and mass production. MIMA believes that by bringing the ordinary citizen, affordable architecture (rather than reserve it for the elite), will contribute to strengthening the future of architecture.

Although the Japanese have been able to live with thin, translucent, fragile room dividers, it is difficult to assume that the Western community would easily give up their conquered visual and auditory privacy. For this reason, if we are to speculate over an open-space home, it would be best to use a sound-resistant room divider that could be lightweight for easy portability but also low-cost. These dividers should have different transparencies so that they could be applied to different contexts involving children, adults and the elderly.

ClearSonic is a company specialized in sound-proof dividers and sound booths. They have a wide variety of sound-proof panels that can be either transparent or totally opaque. The opaque types are made from Velcro (felt) which is very sound absorbent. Some of the transparent types are made from acrylic glass that is highly used for sound barriers in freeways for sound confinement. The outline of its attributes:

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17.10 | SPACE - SAVING LAYOUTS

- free-standing, flexible wall system with superior sound control;
- 99% transparent as window glass (1/4" Thick);
- low cost, portable, effective, flexible;
- soundproof and lightweight;
- panels connected by extremely durable transparent hinge;
- there are no gaps between the panels for sound to escape;
- they fold in accordion style for easy transport and storage;
- there are cable cut-outs between every panel section;
- the bottom of each CSP section is protected by a steel reinforced black rubber-like base trim;
- comes with a safe and comfortable carrying case;
- possible to install height extensions without any additional settings;
- to improve sound absorbance, it's possible to add Velcro panels to the inside walls and a top lid turning it into an isolation booth that will reduce sound leakage up to 70%.

For an optimal environment for teaching and learning, sound should be managed to reflect lower frequencies (16-500 Hz) and absorb higher frequencies (11,000-4,000 Hz). The reason behind this lies in the fact that most higher frequencies are disruptive and distracting to human thought and so should be absorbed and lower frequencies provide a masking effect and so should only be reflected. ClearSonic Panels are optimized to provide the best sound management for a teaching and learning environment.

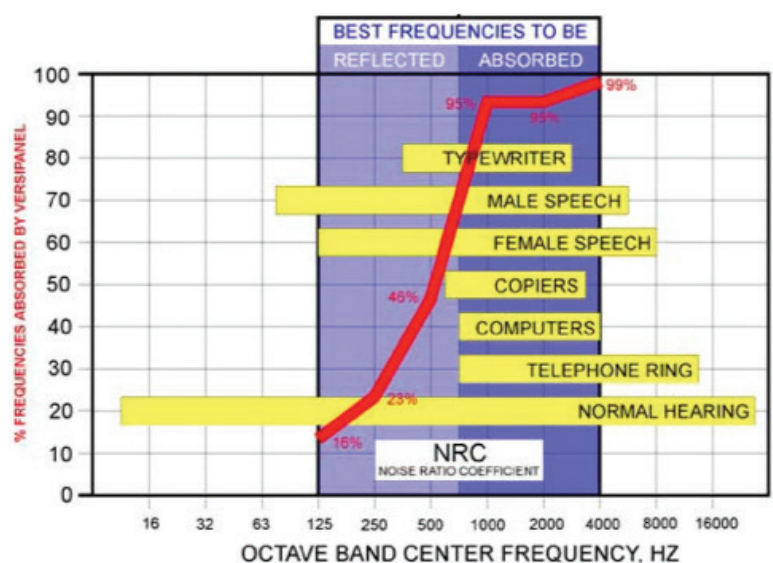


Fig.62 Graphic of sound performance (Frequencies absorbed by ClearSonic's Versipanel).⁴⁵

45 Source: <<http://www.silentsource.com/efs/fwpanels-versipanel-acoustic.htm>>- accessed 31.12.14

17 | SPACE - SAVING FURNITURE

17.10 | SPACE - SAVING LAYOUTS

To add sound absorbing qualities to a normal wall you can either take it down and rebuild it or add layers. These moisture, fire and sound absorbent tiles which are also water resistant, can be added as an extra layer to a normal wall. The tiles are made in an environmentally friendly way, from wood and excelsior or wood wool – which is commonly used to stuff teddy bears or for packaging.

Paper Walls are light, easy to unfold and can be either opaque or transparent to light. They are the easiest flexible walls although they may not be the best sound barriers. Foldable paper can also be used to build furniture like benches or tables.

Curtains are another way to separate rooms. They provide visual and acoustic privacy, they are light, and they are very easy to fold. However, they can't be moved around. The same happens with sliding doors. They can efficiently separate one room in half, but they can't move to allow for different room sizes. Finally, modular partitions have the advantage of achieving irregular forms while also being very attractive to the eye.

Lightning sometimes takes up too much space on the floor or on top of tables, therefore it would be beneficial to also find space-saving solutions for lightning. One idea would be to use the floor as a spotlight or to integrate lightning inside multifunctional furniture.

Apart from the already mentioned self-heating tables “*kotatsu*” and “Zero Energy Furniture”, heating is usually achieved with radiators, heaters and floor heating. Previously, most of the people used to get an electric floor heater to produce warmth in their rooms, but now a whole system has brought ease and comfort for them in the form of radiant heat flooring. In this variety, floor radiant heat is basically generated through the electric cables that are attached with a slab in either floor or walls. It is considered best because of its safety as well as ease of installation. It obviously consumes more electricity, and will increase your bills.

Making floors comfortable can reduce the amount of furniture needed in a room. Like previously shown in the traditional Japanese house, the floors were covered with *tatami* mats so that they would be comfortable to sit and sleep on, thus the dispensable development of chairs and beds over the centuries. The mat also creates a soft base for creative play and insulate your child from cold floors. Other types of comfortable floors can be achieved with EVA foam tiles, cork tiles or carpets. Tiled carpets are modular carpets that can be rearranged into various shapes. The ones shown in the example are made from rubber and woolen felt.

17 | SPACE - SAVING FURNITURE

17.10 | SPACE - SAVING LAYOUTS

The bed is the biggest piece of furniture in a house, and is used only once a day. So the addition of the Second-floor Bed into the small house design was greatly beneficent to gain more space. A cheaper solution to this approach is the Loft Bed which doesn't need home construction.

To utilize the corners of the walls one can install a sink (in a bathroom or kitchen), or corner furniture such as a closet, a desk or a bookshelf.

3D printed joinery can give furniture a flexibility that is very difficult to achieve in any other way. It can basically give the buyer the freedom to join sides and make their own combinations of furniture. This can increase the possible uses of a certain amount of material. Instead of building a chair, with a certain amount of material, and only being able to use it as a chair, by separating the pieces you could now use the same amount of material as a chair, a table, storage, etc. This is also very beneficial to the shipping processes because there's no longer the need of shipping an assembled piece of furniture. Now everything can be shipped separately (like IKEA style) and then buyers can assemble it very easily at home. The shown example is KEYSTONES designed by Studio Minale-Maeda. It consists of a 3D printed PA (polyamide, nylon) connector that holds together various components of a piece of furniture. The goal is to introduce an active consumer by only shipping the essential parts of the furniture, and allowing people to print the plastic parts on a home 3D printer (SLS). The wood components can be fabricated using basic workshop tools or a 2D CNC router, without the need for joinery skills.

Similar to the 3D printed joinery is the Magnetic Table which uses magnets to assemble itself. Free of nails, this system of magnet joinery is easy to assemble and disassemble and has potential to create fluid creative forms out of furniture.

With globalization, economy has now a growing need to respond quickly to the market's demand. Rapid Prototyping is an economical solution to mass-producing products. Either because it can reduce the time taken to design a product, by providing quick and cheap test models, or even by providing final models to sell. It's also easier to use and be trained to use and as such it can be much more accessible to the average citizen. The average person is now able to design their own products and fabricate them at a reasonable price, which was impossible when the machinery was only affordable to a big company. In addition, there are small scale workshops that offer digital fabrication spread around the world and available to the citizens, called FabLabs.

17 | SPACE - SAVING FURNITURE

17.10 | SPACE - SAVING LAYOUTS

Some additive and subtractive prototyping technologies that can be done, as of 2016, are: depositing tiny beads of melted plastic (FDM); solidifying resin with ultraviolet light (Stereolithography); fusing powdered material with laser beams (SLS); or using a Laser Cutter to subtract from the material.

This 3D printed example is “Sofa So Good” an entire sofa that was printed in a single time but only because it was a big machine doing it, (and even that machine has limits). It was printed by 3D Systems in a single piece with a ProX 950 SLA, one of the largest printers by 3D Systems. It used 2.5 liters of resin material for the 150 x 75 x 55 cm., and took several days to print 6.000 layers (each measuring 0.0099 cm.) This Stereolithography machine builds up the shape from a photo-reactive resin by curing it with a UV laser. By using less material, Kyttanen, the designer, hopes to minimize energy consumption and reduce transportation costs for furniture production.

“How much material would we be able to save from products and building materials if we could manufacture like this?” he said. “There’s a whole range of benefits we can’t even fathom today.” (Kyttanen, 2015)

The contribution of this sofa is on the simplification of construction (which conventionally has many different materials like wood, foam, metal structure and fabric), and also in the reduction of the weight from an average of 40kg to only 2.5 kg. This is an interesting feature because while it is strong to hold weight, it doesn’t have to be heavy and that allows for very easy lifting and flexibility of the room.

By using the entrance hall as a shoe-storage division (genkan), it is much easier to maintain the house clean. Reducing household chores and improving the sustainability of our homes are crucial to raise quality of life in developed countries. A very expensive but also popular robotic cleaning appliance is the automatic vacuum cleaner. The Roomba 980 builds a map of the house and then intelligently navigates to make sure that it covers every spot. It can make its way from room to room, and get back to its charging dock when its battery gets low, and then continue right where it left off. Automatic vacuums seem to be very expensive at the moment, but they also have plenty of offer and this offer will continue to grow.

18 | ACTIVE RESEARCH

In a very initial stage of this dissertation the author developed a simple project that attempted to solve the main issues of the Western house, explained in the very beginning. After a class presentation, on the purpose of this project, there was a brainstorm where everyone contributed with suggestions for the way forward. Added to the needs already collected, it resulted in this pyramidal wishlist.

Some of the topics resulted difficult to research due to lack of information, but may as well contribute in a future complementary study.



Fig.63 Wishlist (Author, 2015)

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The project began by proposing the development of an attractive, easy, modular system of floor storage, with the following characteristics:

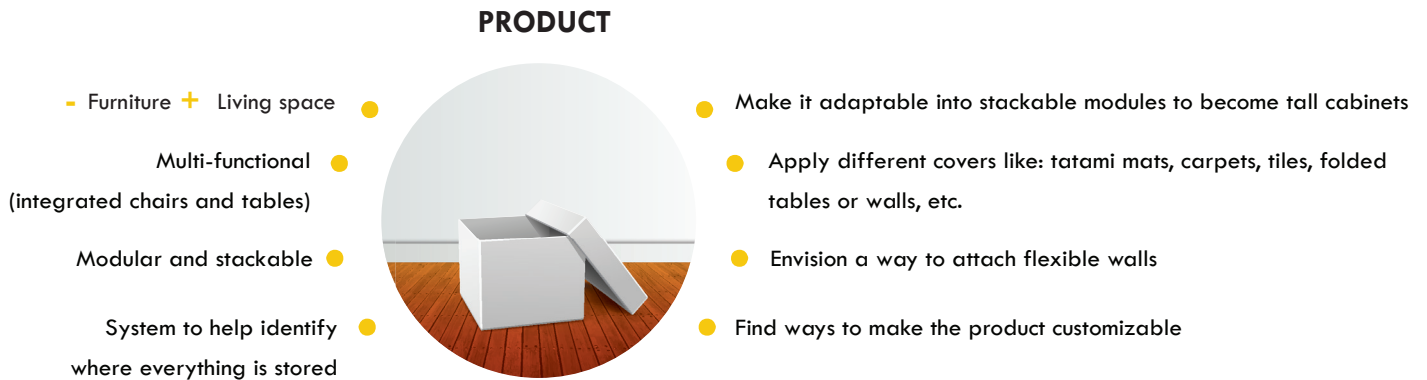


Fig.64 Floor boxes overview (Author, 2015)

The initial idea was very futuristic. It represented the maximum efficiency that this project could achieve in the long-run.

"Imagine that with a mobile app you could change the layout of the furniture of your home. Imagine you have a dinner, a party, or an event and before arriving home you could drag the sofa, the chairs, the tables, but on your phone. And when you got home, it was all magically organized without needing any extra effort to drag furniture. For this to be possible, without having to build custom furniture for every home, it is necessary that:

- There is room in the house to move and have flexibility;
- The furniture is versatile, modular and utilizes space with storage;
- That the furniture can be stacked or shrink in similar ways;
- The furniture has electrical and wireless systems to communicate with each other and with the phone;
- That autonomous mobility is integrated in all modules."

From this premise the project developed into system of customizable, stackable boxes that can reduce the amount of furniture, increase flexibility of space and make floor-level living comfortable, by using padded mats as lids and incorporating holes in the floor (*horigotatsu*). The advantages are not only to save storage space, but also to create various types of use with one module. A module can serve as a floor with storage and at the same time as a carpet to play. Or as a cabinet with drawers, or without drawers, with multiple doors, or just one. These modules can have lids of wood, carpet, tile (for areas near the kitchen, bathroom, plants or clotheslines).

These are the three graphic panels that were used to represent this project from beginning to finish:

FLOOR STORAGE

System of customizable, stackable boxes that can reduce the amount of furniture for storage and improve the flexibility of the rooms

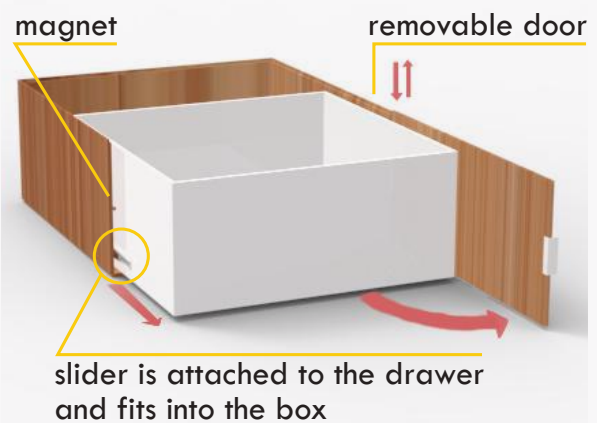
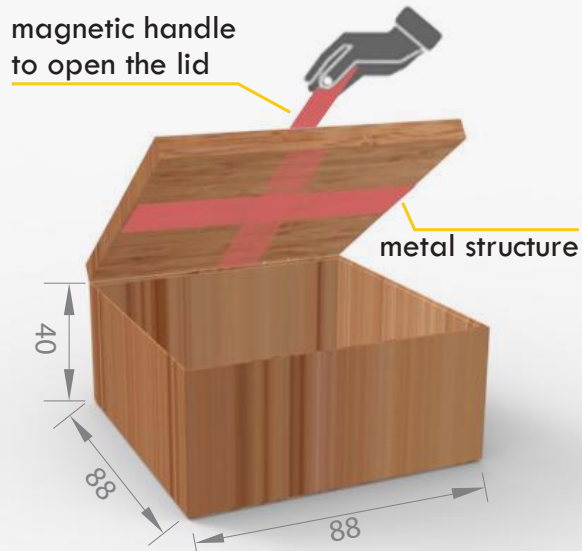
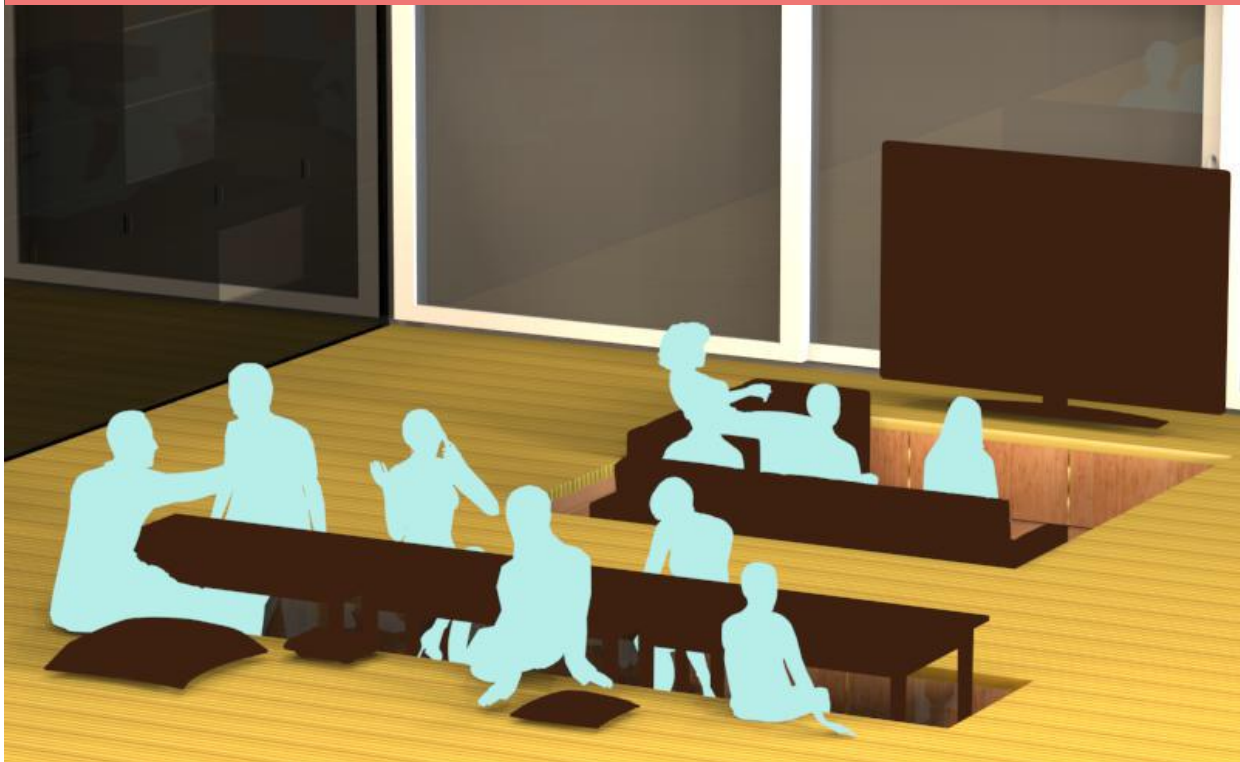


Fig.65 Concept Panel: Part 1 (Author, 2015)

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MATERIALS FOR THE LIDS OR DOORS



FEATURES:

- Holes to pass electric cables
- Magnetic handle to open the floor boxes
- Easy to use, free of nails
- Uses magnets and fittings
- Very customizable pieces
- Easier cleaning
- Easy lifting system
- Two sizes available
- Mobile App to keep track of things



Fig.66 Concept Panel: Part 2 (Author, 2015)

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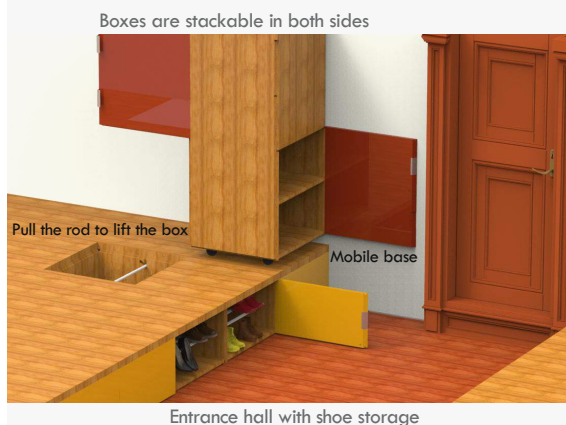
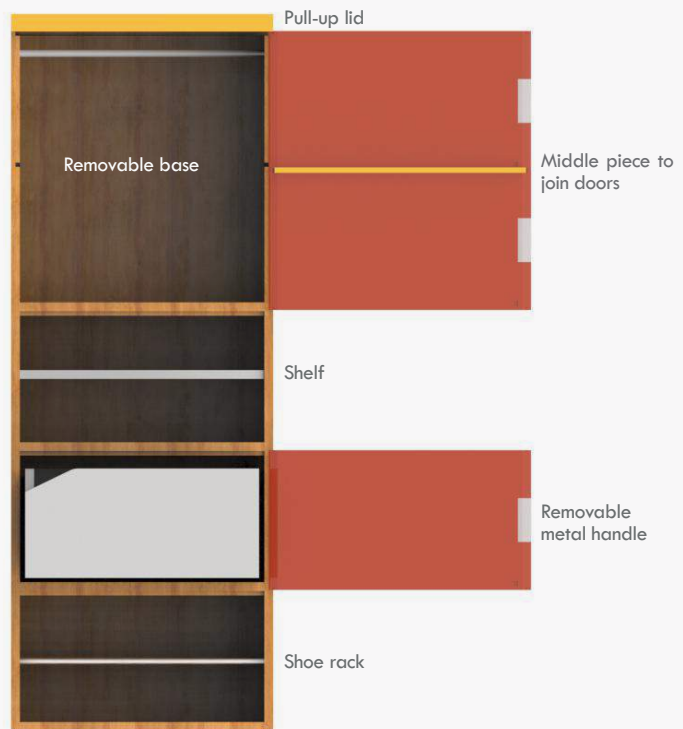
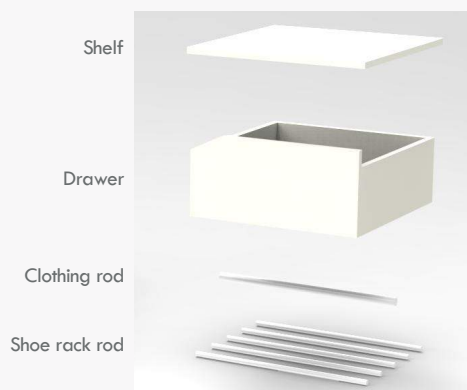
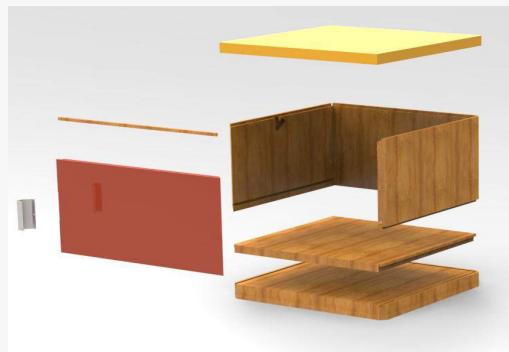
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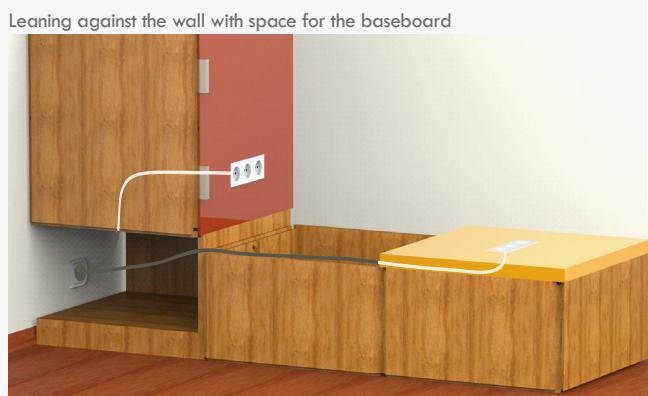


- Modular
- Customizable
- Stackable
- Reduce amount of furniture
- Increase flexibility of space
- Comfortable floor-level living
- Multimaterial, floor for every need
- Horigotatsu: holes in the floor

EASY DETACHABLE PIECES WITH NO SCREWS



Entrance hall with shoe storage



Pass the cables through holes under the lids or up the stackable cabinet. Lids and doors can have integrated electric sockets.

Fig.67 Development Panel (Author, 2016)

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The materials of both lids and doors are very customizable: they may be wood, plastic, cushion, foam mat, stones (in order to put wet objects or shoes) can be tiled, or glass, or a translucent material to let light pass through, can have an integrated light bulb, a *tatami* mat, and technology such as a lid with dehumidifier, speakers, or floor heating.

Cushion lids can't be pulled by magnets, suction lifters or have knobs, but they can have fabric handles. Ideally their handles should be hidden underneath the cushion or in between the cushions. Cushion lids can be made of EVA foam, polystyrene, *tatami*-style, etc. When it comes to extremely smooth, flat surfaces like ceramic tiles, glass and maybe some plastic coatings, there's an easy, very small object called suction lifter that can pull up 15kg in the least. This is a simple solution to pulling up floor tiles to reach for floor storage. And for surfaces that aren't smooth and aren't cushion, like wood and maybe plastic, there's another alternative: magnets. Currently magnets are being sold as a way to lock and unlock doors and drawers. These doors and drawers already have knobs or other opening mechanisms but because parents don't want their children to open these drawers, these magnets can be applied very easily.

Electrical cables can be hidden everywhere and there is freedom to create spots for electrical sockets. Also, a module may create holes, like the *horigotatsu*, that may serve to place the legs and thus easily replace the need for chairs. These holes can also be used to put tables, sofas, beds, or to create an entrance hall where you remove your shoes.

Some other features are that:

- This system may be able to have holes through which to pass cables between the house.
- It is easy to use because it doesn't need screws.
- Despite being modular and of similar size and similar structures, you can add drawers, shelves, chairs and tables.
- A mobile application can be useful to take photographs of the contents of each box, so as to be able to easily identify where you stored your belongings, to activate the lights of the modules, etc.

Some of the feedback received on this project included the wish of one professor who desired to separate the living room from the dining room with floor height, without having to spend a lot of money and if one day he got tired of it, it should be easily adaptable to something else. Another issue was that when buying modular furniture it tends to all have the same size, but if we want to store something bigger than the module, it's impossible to fit anywhere because all the modules have the same size. He found that this project could solve both these issues.

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Another professor pointed out the advantage of using 3D printed joinery as it can give furniture a flexibility that is very difficult to achieve in any other way. It can basically give the buyer the freedom to join sides and make their own combinations of furniture. This can increase the possible uses of a certain amount of material. Instead of building a chair, with a certain amount of material, and only being able to use it as a chair, by separating the pieces you can now use the same amount of material as a chair, a table, storage, etc. This is also very beneficial to the shipping processes because there's no longer the need of shipping an assembled piece of furniture. Everything could be shipped separately (like IKEA style) and then buyers could assemble it very easily at home.

Some final thoughts on the project for its improvement:

- Will the floor boxes make noise if someone steps on it and it's empty inside?
- How to fill the remaining space between the boxes and the walls.
- Find a more adequate, light, cheap and sustainable material (maybe bamboo), and a process of manufacture that will take less workmanship, because the final product right now is very expensive..

Although this concept box isn't Japanese and doesn't look Japanese, the entire system applied to a home reduces the amount of furniture needed which could be seen as bareness of space. Also, the Japanese have the custom of having a hole in the floor for sitting, they also have floor storage furniture, they traditionally use *tatami* as a floor cover, they have floor-sitting customs, Japan already has a market for floor boxes, Tokyo is one of the biggest overpopulated cities in the world, and there they already have micro homes.

For all of these reasons, the name for the brand of this floor box was chosen to be: NIHOME. NIHOME derives from "Nihon" the Japanese word for "Japan". Nihon is written with two kanji characters: 日 (ni) and 本 (hon). Because Nihon and NiHome sound very similar, the logo took advantage of these two meanings and blended them, turning the 日 into an "O" when read in English. This way, a foreign person will read NIHOME and remember the sound of Nihon (Japan), while at the same time receiving clues with the kanji that it is indeed an Asian store. And a Japanese person would first read 日本 and then the HOME blended in with a romanji alphabet (romanji is what the Japanese name the Western alphabet, along with the kanji it makes 2 of the 3 alphabets used daily in Japan).



Fig.68 NIHOME logo (Author, 2015)

The logo works for both the Western and Japanese market and is able to communicate that the original inspiration comes from Japan and that the products are purposed for the home.

19 | SURVEY RESULTS

To understand how feasible it would be to apply in a Western home any of the previous furniture options presented, we will now analyze the results of the online survey done in June and July of 2016 in Portugal with a Portuguese version, and in foreign countries with an English version. An example of the online survey can be viewed in Appendix 15, and the full results disclosure is available in Appendix 14.

Half of the sample is aged from 12-31 and one third of the sample is aged from 32-51. It may or may not be an advantage to have such a large portion of the sample in these age groups, depending on the assumption that younger people tend to be more accepting of different ideas.

| Year Born | Age in 2016 | Nº of respondents | % of total sample |
|--------------------------|-------------|-------------------|-------------------|
| 1985-2004 | 12-31 | 36 | 50% |
| 1965-1984 | 32-51 | 24 | 33,33% |
| 1946-1964 | 52-70 | 8 | 11,11% |
| Prior to 1946 | Over 70 | 2 | 2,77% |
| Total of respondents: 72 | | | |

Fig.69 Survey sample (Author, 2016)

“The biggest potential disadvantage to online surveys lies in the representativeness of the sample. Are the attitudes and opinions of internet users (and specifically those registered with an online research company) different from the greater population? As close to 80% of U.S. households have a computer with internet access in their homes (Nielsen 2008), the advantages of online surveys are viewed to outweigh any potential disadvantage”.

(Ponder, 2013:6)

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Assuming all of these options have an equivalent cost, would you rather:

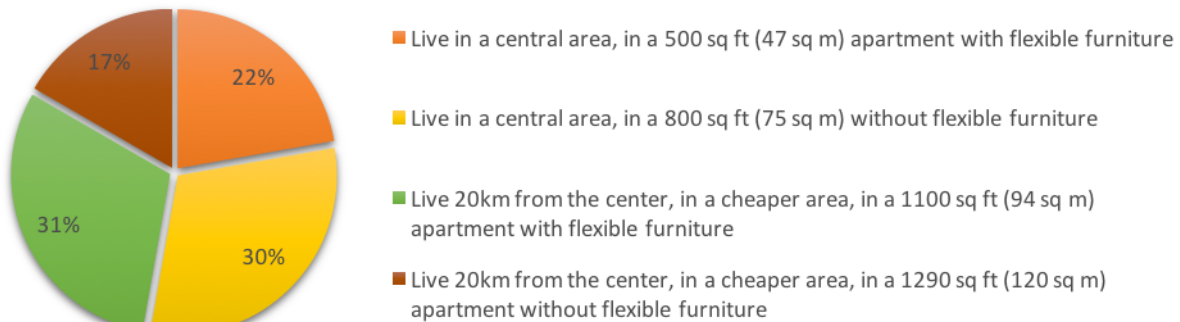


Fig.70 Preference in house location and price (Author, 2016)

If space were needed to raise a family, moving to a larger house is still much preferred comparing to optimizing the existing space with renovations. But living nearer to the centre is also a priority. So although ideally people would choose the bigger house they could afford, if they had to choose how far they would live from the center, they would choose to live the most near to the centre possible, with the least sacrifice in space possible. For this reason, the most central and smallest-sized home (still with double of the size of NY's smallest micro homes), wasn't the most voted.

What do you prefer?

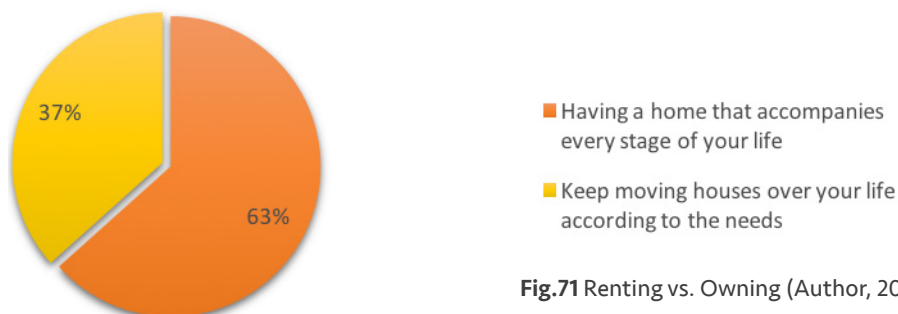


Fig.71 Renting vs. Owning (Author, 2016)

There are two ways that Westerners choose to live throughout life. The first, and old, is buying a house that will last for life. The second is changing houses according to the needs of the household. It is expected to exist a lot of people who want to change houses, because the changes in the job market gave the possibility, or misfortune, to be able to change jobs regularly, and because globalization gave a chance for worldwide migrations. Although 71% of the respondents own a home, only 63% prefer to stay in the same house rather than change houses, which means that 8% of the respondents regret owning a house. Also, the most popular ideal household sizes voted were, first, a four-person household, and second, a three or two-person household.

19 | SURVEY RESULTS

It is important to introduce new homes that are developed and optimized for a specific amount of people, like the new micro homes are. But because the majority still seems to want to live in only one home in life, it is even more important to invest in ways to optimize space for these fluctuating households.

Although 85% of respondents were from Portugal, a country that doesn't experience overpopulation in the same level as Tokyo or New York, the three consequences that respondents reported to have were that 14% had too many people per m², and 9% experienced pollution and bad availability and prices of housing and parking.

Micro homes were the solution presented for overpopulated cities. It sacrifices space for affordability and population growth, and is aimed for people who don't spend too much time at home. In this survey 50% of respondents spend only 10-14 daily hours at home which is an impressive low amount of time. 28% spend less than 9 hours a day at home, which is equivalent to the recommended amount of sleep per day. These results demonstrate that there is a large target group who doesn't spend time at home and could possibly benefit from living in a micro home.

With the increasing economic difficulties, there is and always has been a need to turn small-sized apartments into comfortable living spaces. While some people live their lives trying to ascend the hierarchic ladder of social classes to obtain a more comfortable life, this struggle is unnecessary as a small apartment can be correspondingly satisfying with the right adjustments.

When you are buying furniture what does more commonly happen?

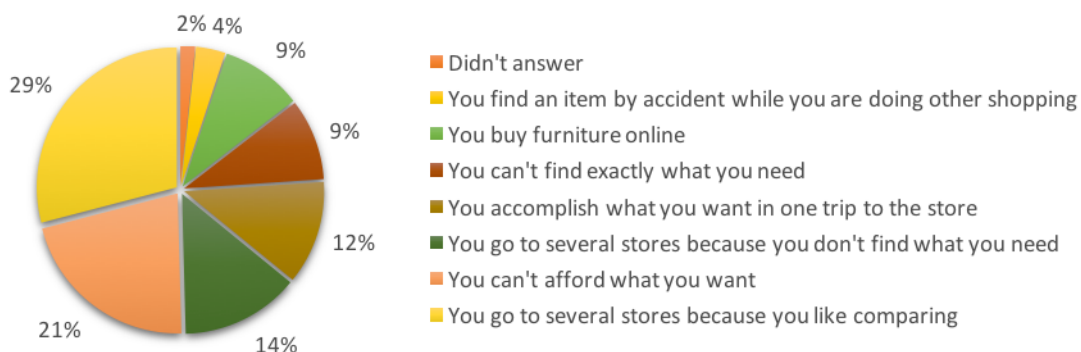


Fig.72 Furniture availability (Author, 2016)

When it comes to buying furniture, we will compare the results of this survey with the results of other surveys.

19 | SURVEY RESULTS

The majority of the respondents can't afford what they want to buy and have to visit several stores to compare prices. 19% said that they never found available a specific type of furniture they wanted. Visits to stores, internet and catalogues are the most used methods for research.

The main reasons for buying furniture were because respondents had moved or relocated, replaced old-dated and broken furniture, remodelled a room, and needed that furniture. "In the case of furniture, problem recognition is likely to occur when a consumer experiences a significant life change, such as getting married, purchasing a first home, having children, or downsizing due to retirement and/or children leaving home." (Ponder, 2013:9)

What factors do you value when buying furniture ?

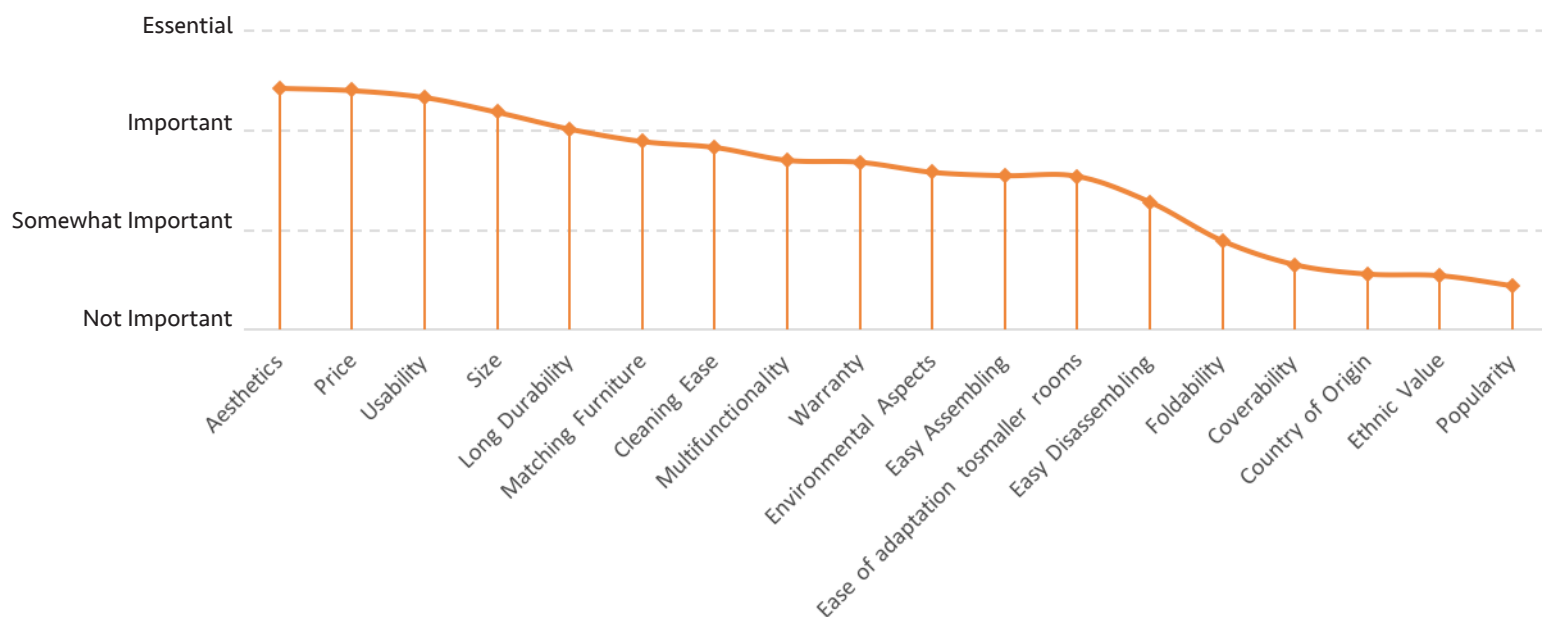


Fig.73 Furniture value (Author, 2016)

In this survey, the most important factors that gave value to furniture were esthetics, price, usability, size and long durability.

"Educating consumers on how to specifically evaluate quality in furniture will help to ensure them that the piece of furniture they choose will last a long time". (Ponder, 2013:31)

If we compare to the graphic below, where buyers were asked to specify their critical success factors, and to rank these on a scale of 1 (not important) to 7 (very important), we can see that quality and price were very important too.

19 | SURVEY RESULTS

Delivery is apparently a very crucial factor when buying furniture which means that suppliers to global retailers are confronted by a much more demanding set of critical success factors than if they sell to small retailers and specialist buyers. Not only are almost all the critical success factors considered important, but they are also ranked as being of higher-order importance.

The following analysis was made to US consumers and so should only be appropriated for similar contexts of consumism present in developed countries.

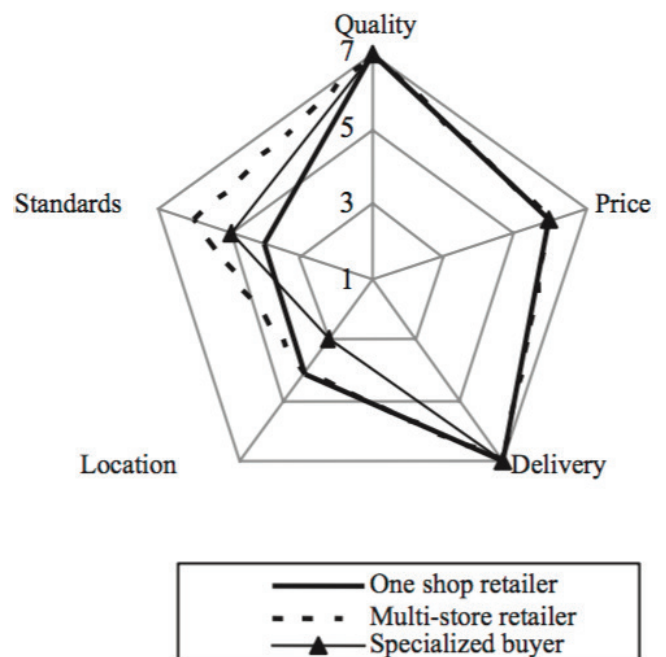
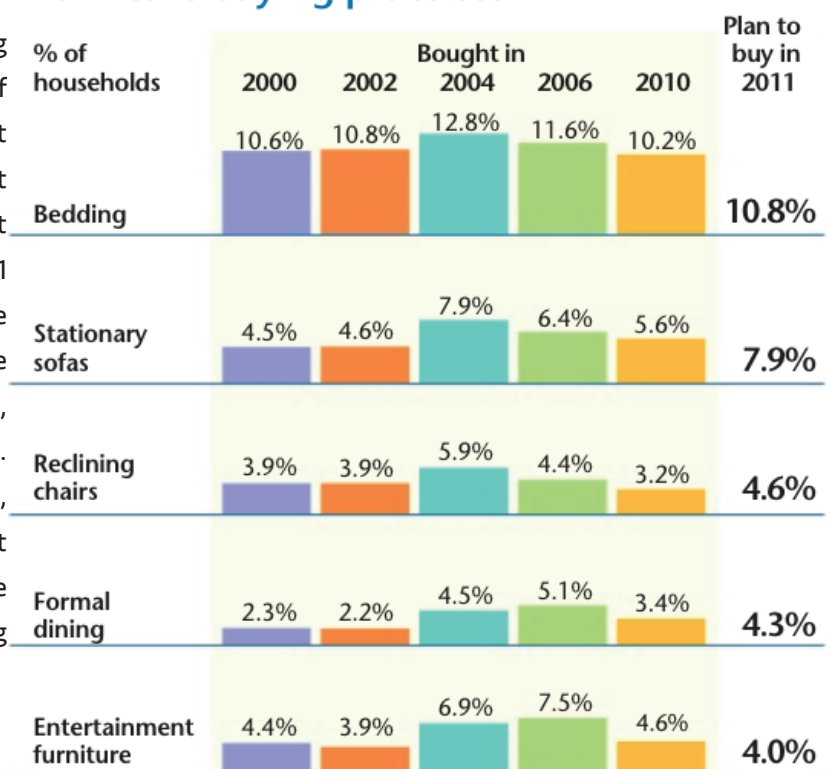


Fig.74 Buyer Preferences. Source:

<http://www.ffi.msstate.edu/pdf/consumer_attitudes.pdf>- accessed 16.05.16

Furniture buying practices

By analysing furniture buying practices we can get an idea of which is the most important furniture for consumers. In first place comes the bed, the most bought furniture in the last 11 years. From the second place forward, consumers invest more in the public spaces of the home, like the family room or den. Stationary sofas, reclining chairs, formal dining and entertainment furniture are some of the furniture that facilitates sharing a public room.



Source: Furniture/Today Consumer Buying Trends Surveys, 2001, 2003, 2005, 2007 and 2011

Fig.75 Furniture buying practices. Source: <<http://pt.scribd.com/doc/52877062/Furniture-Today-Consumer-Buying-Trends#scribd>>- accessed 16.05.16

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What is your favorite piece of furniture you own or would like to, and why?

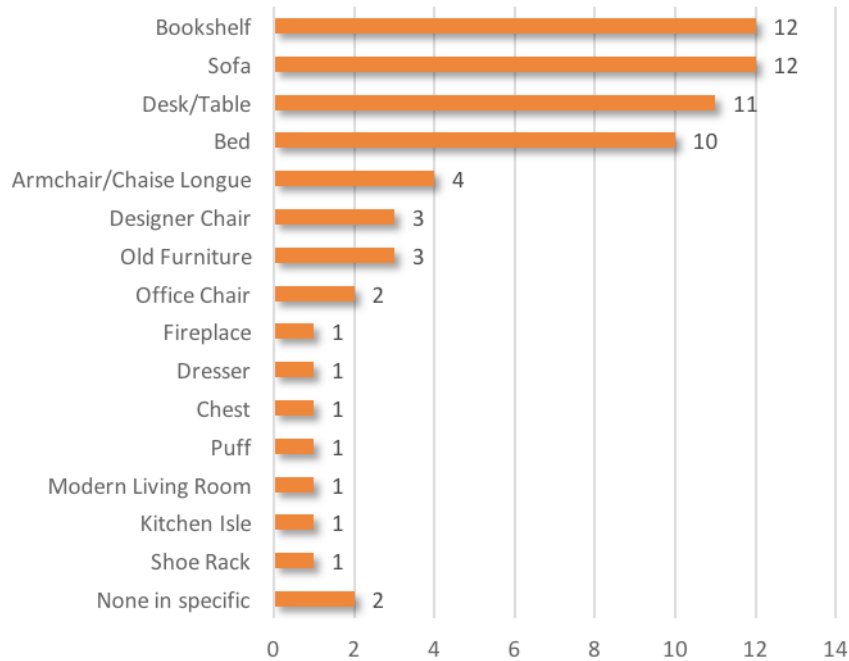


Fig.76 Favorite Furniture (Author, 2016)

In our online survey, when asked what their favorite piece of furniture was, the bookshelf and sofa were the most answered, following the desk/table and then the bed. The reasons were that they liked organizing their books, the comfort of their sofa, and they spent a lot of time in the privacy of their desks and beds. "My bed, it's my only furniture that's essential, it's the most comfortable thing to sit on."

In a Mississippi survey (Ponder, 2013), respondents said that:

"I am very proud of my furniture and also my art work. It reflects who I am and what I believe in. I like who I am!" 69 year old Caucasian, female in Ohio

"Furniture is an extension of me. It has to be functional but classically designed and high quality. Color is an important way to express my personality in my furnishings." 51 year old Filipino female in New York

Consumers also choose the living room as their favorite room in the house. Their shopping tendencies are accordingly. After the bed, the most bought furniture is meant for socializing. But they have even more reasons to buy furniture, like having a significant life

19 | SURVEY RESULTS

change such as dating, marrying, having children,... For this reason, furniture has a lot of meaning. It accompanies them throughout their lives, their happy parties, their important moments. Many believe that it represents them, their style, personality and passion, which brings value to furniture's variety and customization.

"It is where my friends and family gather to relax and enjoy one another"

"Home furniture makes the house feel like a home. It represents a person's style and personality. It makes the rooms more comfortable and relaxing and inviting to family and guests." 40 year old Caucasian, male in Wisconsin

Furniture purchases occur when a problem or a need is recognized (usually triggered when there's a significant life change). It's often an emotional and important process. Manufacturers shouldn't sell a product, but a way for consumers to spend time comfortably with family and friends.

When asked how much money respondents would or have spent furnishing their homes, 40% said between 1 000 and 5 000€.

How much money would you/have you paid to furnish your home?

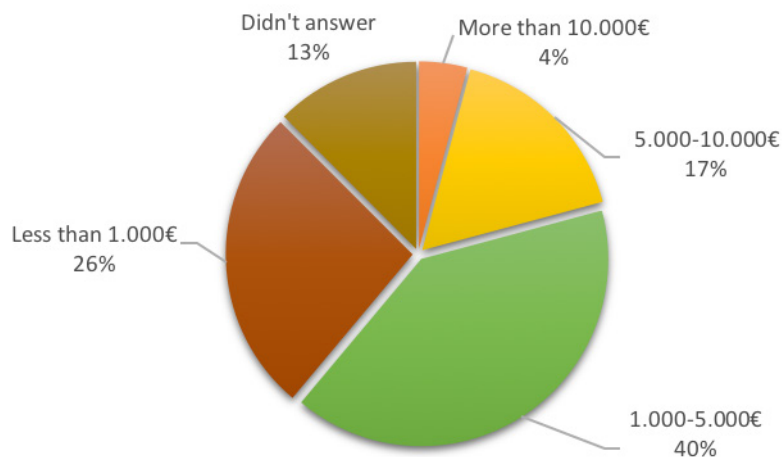


Fig.77 Furniture Investment (Author, 2016)

"Furniture is a product that requires extensive problem solving, as it is expensive, durable, and not purchased with great frequency. Further, many consumers view their homes and the furniture in them as an extension of themselves, so it can be considered an emotional purchase (Perry 2007)." (Ponder, 2013:1)

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An interesting comparison can be done between the previous graphic and the following one. Spending less money furnishing their homes seems to be related to the impressive 51% of respondents that answered that they had just the right amount of furniture inside home. While 17% said they would spend from 5 000 to 10 000€ furnishing their homes, there was also a 17% said that said they had a little too much furniture. And while 4% said they would spend more than 10 000€, there was also a 6% that said they had so much furniture that they barely had space for anything else.

How much furniture do you have?



Fig.78 How much furniture do you have? (Author, 2016)

We can assume that the people who own too much would like to reduce the amount of furniture they had and gain more space, but they don't do it for some reason. This could be because each furniture has a single function, and having a piece for each function occupies too much space; the furniture can be expensive or inherited and they have pity of getting rid of it; they can't afford to store it in a garage, or storage facility; or they don't have space to put it in their garage because, like one person answered, on top of having so much furniture they can barely move, they also have a lot stored in the garage.

As an extreme solution to exclude excess of furniture as a problem, suppose we could radically remove all furniture, start using easy, collapsible, storable furniture for dining tables, and folding chairs. The beds could be either collapsible beds, futon mattresses, or platform beds made with tatami for those who want to experience sleeping on a tatami mat without having one.

Although no need for furniture would be the perfect situation, it can be hard to live comfortably in an empty house. Even for floor-levelled lifestyles the Japanese have developed legless chairs for back support, sunken floor areas to place the legs under low

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tables, and these low tables (sometimes even trays) are used for having dinner or studying. We can't expect every Westerner to abruptly stop purchasing objects, and it certainly isn't necessary to make him live at a floor level. In a Western house we can also find comfort in normal levelled furniture, which if it's collapsible and easily storable, it's even better. This decrease in furniture can be beneficial for us but it certainly also benefits the environment, for it fights this consumerist path that is producing uncontrollable amounts of waste.

who would pay? **LESS** 59% age +70
\$800 51% age 51-69
for eco-sofa **MORE** 56% age 39-50
59% age 21-38

In the previous Fig.73 of our online survey, respondents classified environmental aspects as a somewhat important aspect of furniture. But, in this Mississippi survey, when asked if they

would pay 800\$ for an environmental friendly sofa, people aged from 51 years old said they would pay less than that. And people under 50 years old said they would pay more (Ponder, 2013).

Despite this, an EU study concluded that ecological furniture doesn't necessarily have to be more expensive. It said that the difference between brands had a bigger impact on the price, than differences between green and non-green versions.

In addition, the opinion of a surveyed consumer was that the products should have more visible labels with information regarding their ecological value and the materials they are made from.

Manufacturers should provide clear and detailed information regarding the materials used to create the furniture, and not require the consumer to work hard to obtain it.

Differences between fittings or brands seem to have a greater impact on price than differences between the green and non-green versions.

"It is sometimes difficult to find environmentally friendly items – or know if they are. It would be nice if more companies clearly labeled how/what something is made out of and where it is made. It is not easy lifting a bookshelf or chair to read a tiny sticker underneath!" 34 year-old Multicultural, female

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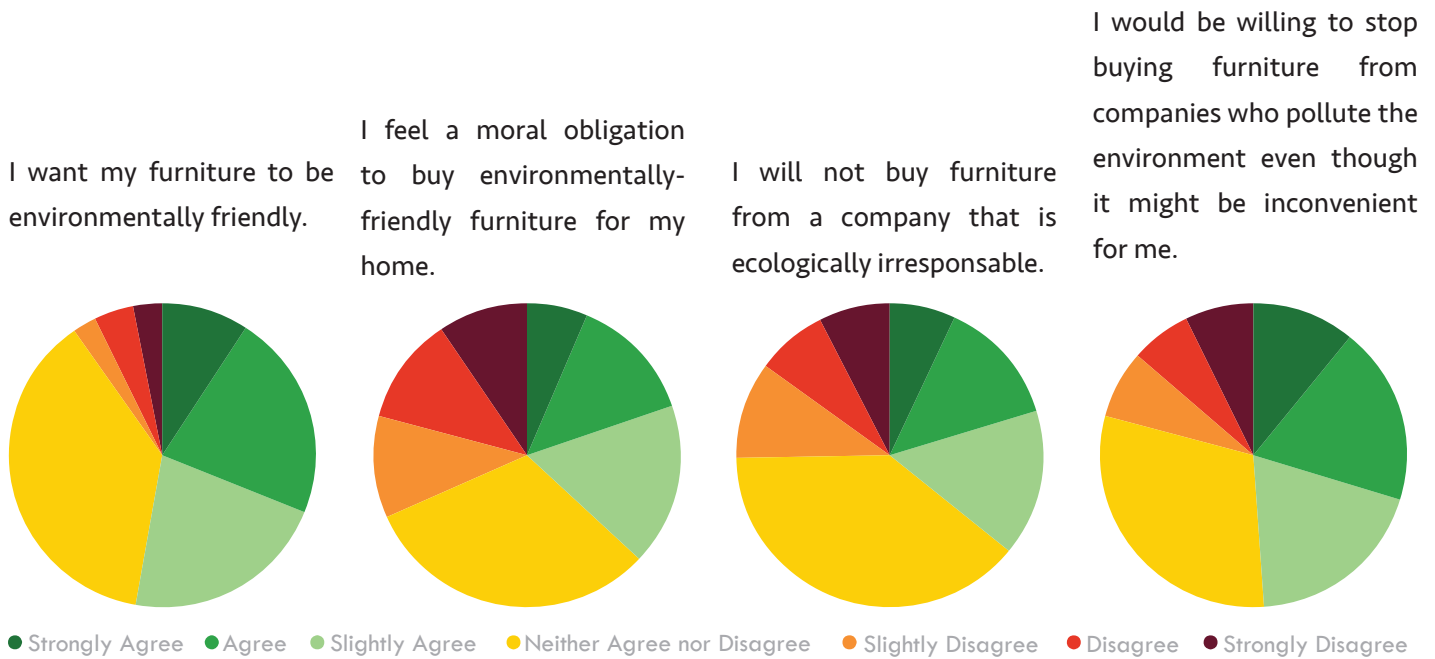


Fig.79 Consumer opinion on environmental friendliness⁴⁶

Now that we have analyzed the cultural tendencies for buying houses and furniture, we are going to analyze what the consumers are lacking in their current homes, and what they would ideally prefer to change.

Only 26% of respondents said that they didn't need an extra room or more space. From the 74% that did need, 25% of respondents answered that they needed more space, and only 16% needed an extra room.

The question of how flexible Western people like to be inside their homes was answered in the next graphic that showed that a large majority actually likes entertaining guests or family members, which is one of the things most people abstained from doing because they lacked space. The most radical types of flexibility with which people still identified with, were the ones in which they would sit on the floor, or have guests sleep on the floor, in order to have them over, and the one in which they wanted their guests to take their shoes off when entering.

⁴⁶ Source: <http://www.ffi.msstate.edu/pdf/consumer_attitudes.pdf>- accessed 31.12.14

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With which of these phrases do you identify?

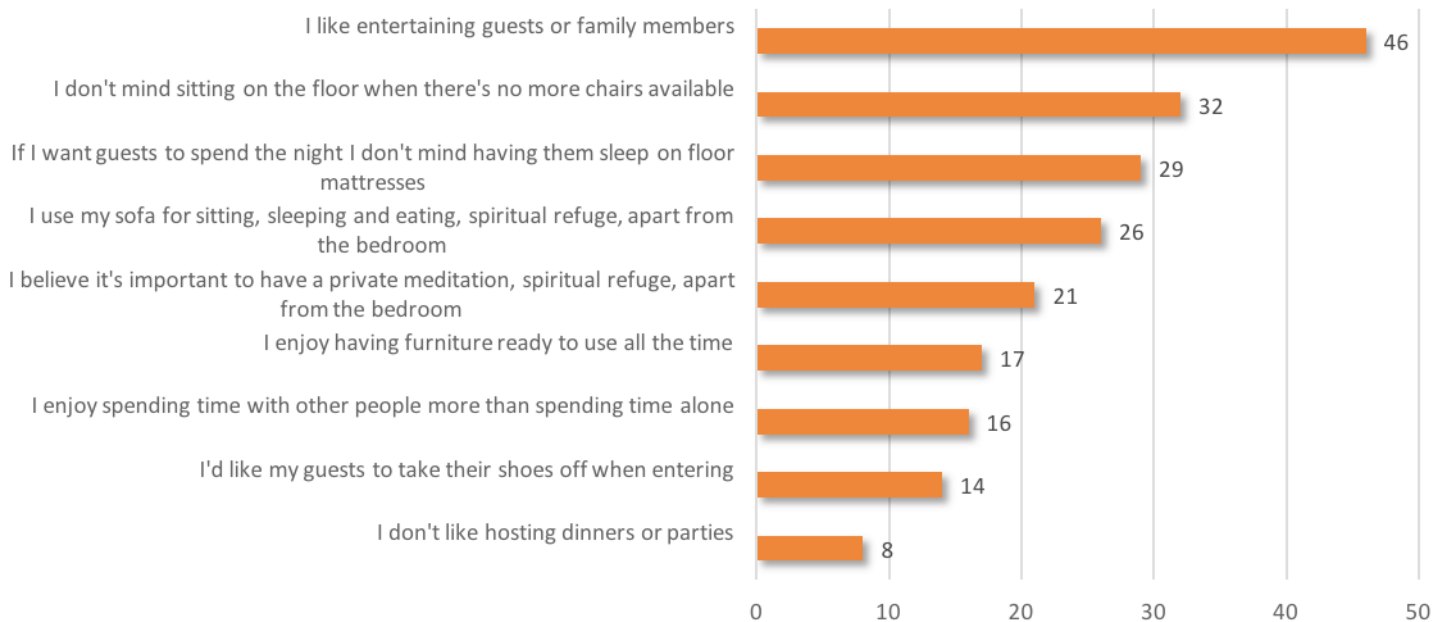


Fig.80 With which of these phrases do you identify? (Author, 2016)

All of these sacrifices were in the name of being able to do more activities inside the home. One easy way to do that is by starting to have multifunctioning rooms, instead of rooms for just one purpose. In the question of if they would like to have a different home layout, 36% of respondents agreed that they would.

Would you like your home to have a different layout?

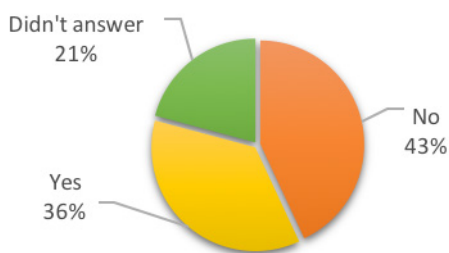


Fig.81 Home layout (Author, 2016)

The proposed solution for this unflexibility problem would be to have a large one-room open space house. Does it still matter if we have walls in our house? What are walls for, if not for separating permanent spaces equipped with permanent furniture? If our furniture isn't permanent anymore, nor should our walls be.

The Japanese have successfully developed a series of dividing partitions that are easily placed and removed whenever there is a need to create a smaller or wider room. Westerners are too accustomed to having solid barriers that provide visual and auditory privacy. For walls to be thrown down, simple shoji panels wouldn't be satisfying for everyone. Removable or sliding walls should be noise-proof, light and easy to install and remove.

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“The feeling that Japanese houses afford little or no privacy is due to the fact that, although the number of barriers is rich in variety, they remain thin and light. But this poses no problem to the Japanese, for there is a certain refinement about a soft, barely perceptible light sweeping through a shōji paper door, or the sound of rain just on the other side of a latticed window” (Yagi, 1982:18).

There are also removable or sliding walls in the Western design. If before we had no space whatsoever to accommodate a guest, now not only could we provide him a mattress to sleep in, but we could also give him a private personal space in no time. How many times did families abstain from hosting parties because there wasn’t enough room for dancing or playing? Is it even worth it to have concrete walls, a bed, a bedside table, a cabinet, a desk, a chair, a bookshelf, a wardrobe, a garbage bin, and a floor lamp if there is no space left for enjoying life and playing with friends?

In which room do you enjoy more spending your time and why?

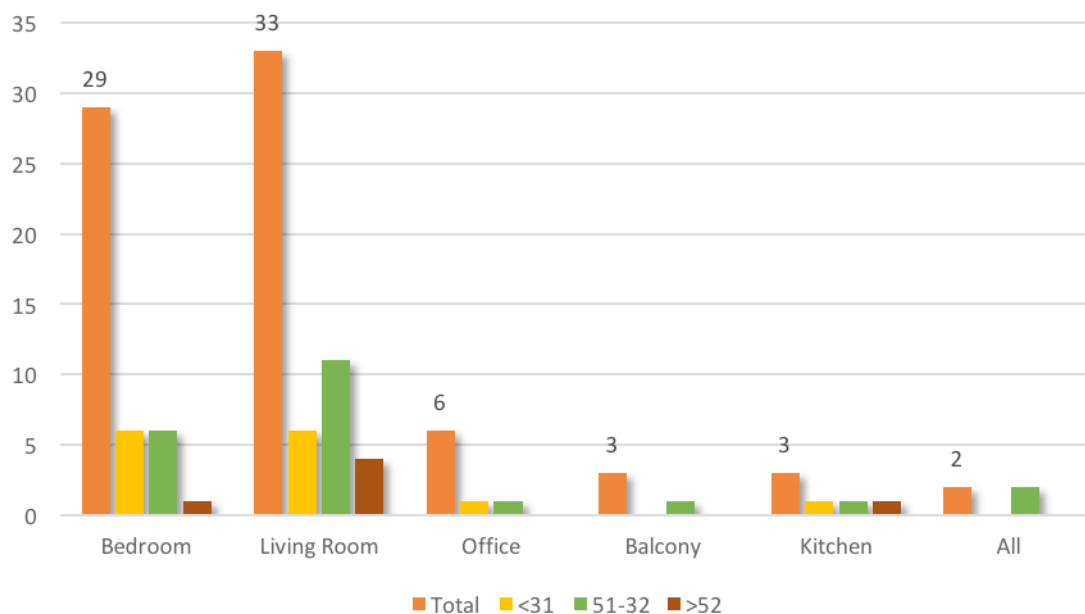


Fig.82 Favorite room (Author, 2016)

In our online survey, 46% of respondents said the living room was their favorite room and 40% said it was the bedroom. In both options the reasons were that they could relax and enjoy time.

“Many people are proud of their furniture and took the time to describe favorite pieces in great detail. Over half of the sample named the living room/den/family room their favorite room. When asked why this room was their favorite, respondents overwhelmingly mentioned the entire family and the living room as a place to share happenings in each other’s lives. (...) As one 41-year-old female puts it, ‘the

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family room [I my favorite] because we spend a lot of time in there together. We have a sectional couch that is one of my favorite pieces because we can all be on it together. (...) This sentiment is echoed by a 26-year-old female, whose favorite piece of furniture is the dining room table because, 'it is where we eat together as a family and it is also where we do family activities like carving pumpkins and school projects.' (Ponder, 2013:12)

Is there any activity that you would like to, but have abstained from doing inside, for any reason?

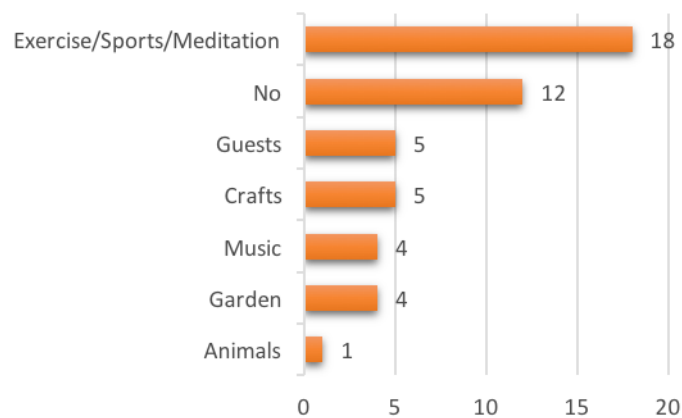


Fig.83 Activities that you have abstained from doing because you lack space (Author, 2016)

Doing hobbies/sports/meditation inside is the main activity that people abstain from doing because of lack of space. Next is having guests spend the night and having dinner and parties. Unbelievably five people abstained from having children because they lacked space.

Having a spiritual refuge in our homes, better than our beds, could improve greatly our daily lives and our relationship with nature and with ourselves. If we had extremely flexible houses, how joyful would it be if we could move the bathtub to the living room and take a soothing bath while looking at the gardens? Privacy could be easily secured with sliding partitions or removable walls. By removing the purpose of each room, we are left with only a house with infinite possibilities. There would be no more need to move to another house when a new family member was born. We could sleep wherever we wanted everyday.

Floor living simplifies a lot of routines and opens a lot of new possibilities. If we wanted to read and catch that glimpse of sunlight, we could magically sit exactly in the best place possible. It would be much like choosing a place to sit when walking in parks. If there's a tree shadow and we are hot, we would want to sit there. If it's cold and the sun is shining in that specific place of the house, we could also be there. Probably only the permanent bathroom lavatory, toilet and shower wouldn't be movable, and maybe even the big electric appliances in the kitchen, like the oven—there is however an approach to a portable kitchen made by Philips called Microbial Home, and maybe there are other similar

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approaches that the author doesn't know of.

We spend too little time connecting with nature and our own spirituality. There is too much focus on the entertainment products and too little on the matters of life. A Japanese garden viewed from our 6th floor apartment living-room would be great of course, but unlike the Japanese traditional home, our apartments have a lot of limitations. First, verandas tend to be small because they aren't that big of a deal in the Western ideals, that prefer to have a bigger living room than a bigger veranda. Curiously this doesn't happen in the same way in a Japanese house garden, as the garden's size is determined first, and only afterwards is the remaining land devoted to the building. And second, a garden would probably be very heavy for our traditional verandas in the West. There is however an attempt to accomplish this fusion of nature and house buildings in recent conceptualizations of "vertical forests". These gardens would also be beneficial to the environment because deforestation problems have reduced the absorption of CO₂, further contributing to the global warming.



Fig.84 Vertical Forest⁴⁷

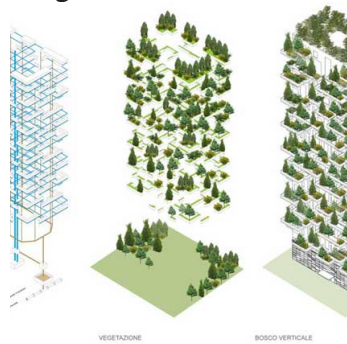


Fig.86 Vertical Forest⁴⁹



Fig.88 Vertical Forest⁵¹

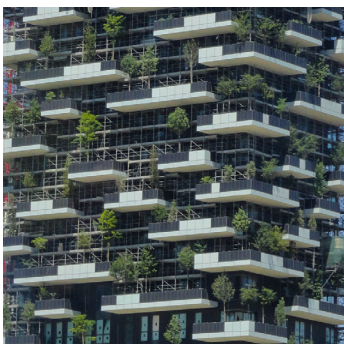


Fig.85 Vertical Forest⁴⁸



Fig.87 Vertical Forest⁵⁰



Fig.89 Vertical Forest⁵²

47 Source: <http://cdn3.collective-evolution.com/assets/uploads/2013/03/vert_forest1.jpg>- accessed 31.12.14

48 Source: <<http://news.fiu.edu/wp-content/uploads/vert2-1.jpg>>- accessed 31.12.14

49 Source: <<http://freshome.com/2011/11/14/stefano-boeris-urban-vertical-forest-bosco-verticale/>>- accessed 31.12.14

50 Source: <<http://www.construction.am/article.php?id=320>>- accessed 31.12.14

51 Source: <<http://freshome.com/2011/11/14/stefano-boeris-urban-vertical-forest-bosco-verticale/>>- accessed 31.12.14

52 Source: <<http://www.technology4change.com/article.jsp?id=374#.VJMQysj3D>>- accessed 31.12.14

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While we wait for the vertical forest trend to be widespread, we could invest in more gardens and parks in residential areas, and try to achieve in our home a meditation retreat. As for villas there is a greater ease in integrating the garden with the house.

“Look for opportunities to bring the outside in. Open up a wall to the back yard and install a large expanse of glass. Use one or more sets of sliding glass doors, fixed glazing, or a combination that suits you. These days, a number of architects and designers are turning to accordion-style glass doors that fold out of the way, expanding the living space to encompass the garden.

A large expanse of glass warrants an equally thoughtful window treatment. A bank of shoji panels along the interior of the glass serves multiple functions: it pleasantly diffuses sunlight, offers a surface upon which trees and foliage cast ever-changing shadows, provides privacy when needed and a bright white reflective surface to cover the dark glass at night” (Gong and Parramore, 2009:17).

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Respondents considered the two most important advantages to space-saving furniture to be, first, the reduction of house chores and second the gain of space inside the home. What the respondents with lack of space abstained most from doing inside was: hobbies and sports, having guests spend the night and hosting parties.

What difficulties do you encounter when cleaning your home?

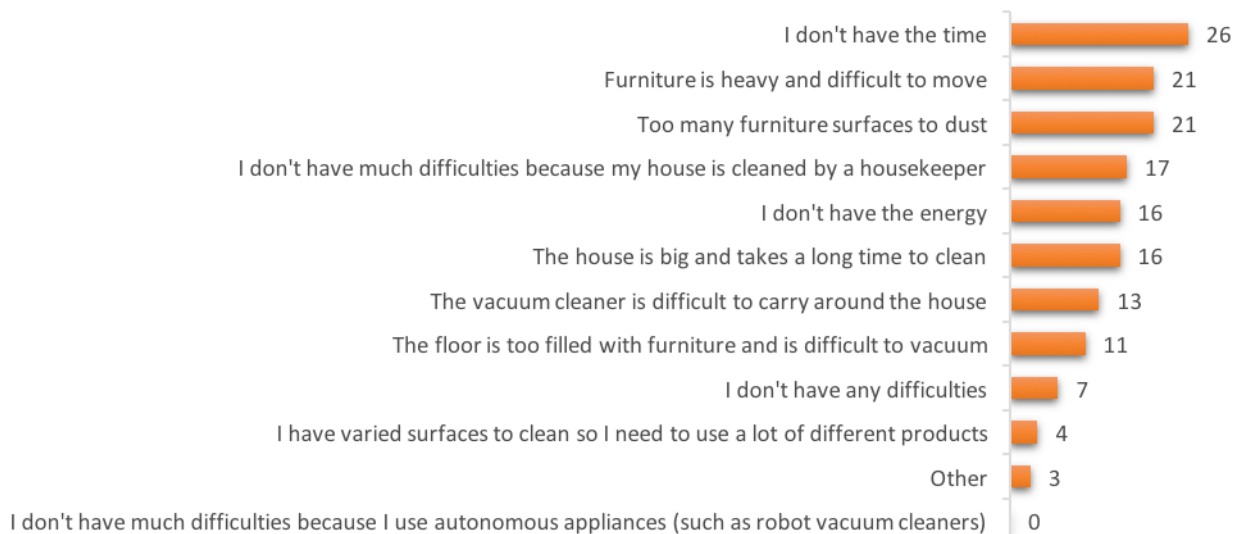


Fig.90 Difficulties in cleaning (Author, 2016)

Cleaning tasks are the main worry. The main worry is that respondents don't have the time to clean, furniture is heavy and difficult to move, and there is too many furniture surfaces to dust. Even though none of the respondents had an Asian background, 13 people were willing to pay more money to be able to floor sit. Robotic cleaners should take advantage of this. When asked how much respondents would pay for a robotic cleaner, from the 48% that would pay for a robotic cleaner, 24% would pay for a good one, 17% would pay for a cheap one, and 7% would pay for a very good one.

Robotic cleaners can vacuum and wash your floors and walls autonomously, but they can be expensive. Would you consider buying one?

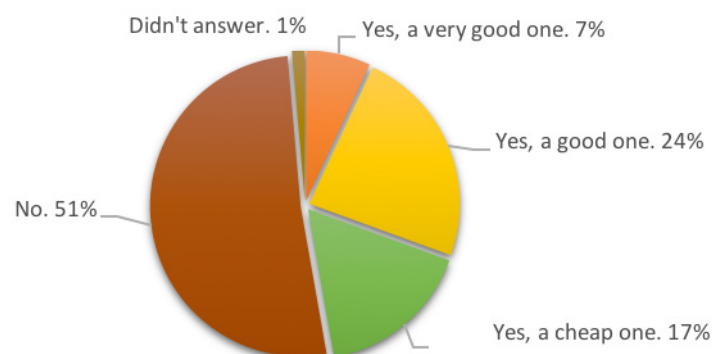


Fig.91 Robotic Cleaners (Author, 2016)

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The amount of time wasted in cleaning a Western-styled room is very big because there is so much furniture that the cleaning chores have to be done manually. Vacuum cleaners need the help of a human to reach every corner, and a device prepared for dusting shelves without lifting objects isn't currently available. Although many families have resigned from having open bookshelves, to avoid having to dust them, the problem of the floor sweeping remains. However, without furniture, imagine how easy it would be to manually vacuum the floors. Even easier it would be, if an automatic robotic vacuum was used as many times a day as we wanted. Recently a Japanese cleaning robotic object emerged, named: "Robotic Floor Dusting Ball Mop". Besides from being economical in energy and cheaper than the robot vacuums, it doesn't make any noise and is very pleasant to the eye.



Fig.92 Robotic Floor Dusting Ball Mop. Source: <<http://internetsiao.com/wp-content/uploads/2013/06/mocoro-robotic-ball-mop-floor-cleaner-2.jpg>>- accessed 31.12.14

Cleaning tasks would be easy if we could have automatic robotic vacuum cleaners or floor mops, and they would further benefit from the integration of the custom of leaving shoes in the entrance. What could also be beneficial to the establishment of this habit would be the raising of the interior floor. This habit to leave outside shoes at the entry has already been widely adopted by Westerners who place cabinets or stones in the entrance for shoe storage. However, there is still not enough space in many houses to do this—neither for placing cabinets nor removing the shoes—and the fact that there isn't a step to divide the interior space from an intermediary space, makes it difficult to communicate to a guest that he is supposed to take off his shoes. Thus, the creation of a levelled hierarchy would be useful to communicate this responsibility and to provide seating support in the shoe removal process.

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We have documented the difficulties that Westerners experience in their homes, but we are still not aware of how Westerners receive existing possible solutions for their problems. In this section, a selection of space-saving furniture was presented to the respondents, and they were asked if they would use any of these options if they were remodeling their homes. We are also going to mention a few of the reasons they gave. The full list of reasons to why they would or would not use each of these options, can be viewed in Appendix 15.

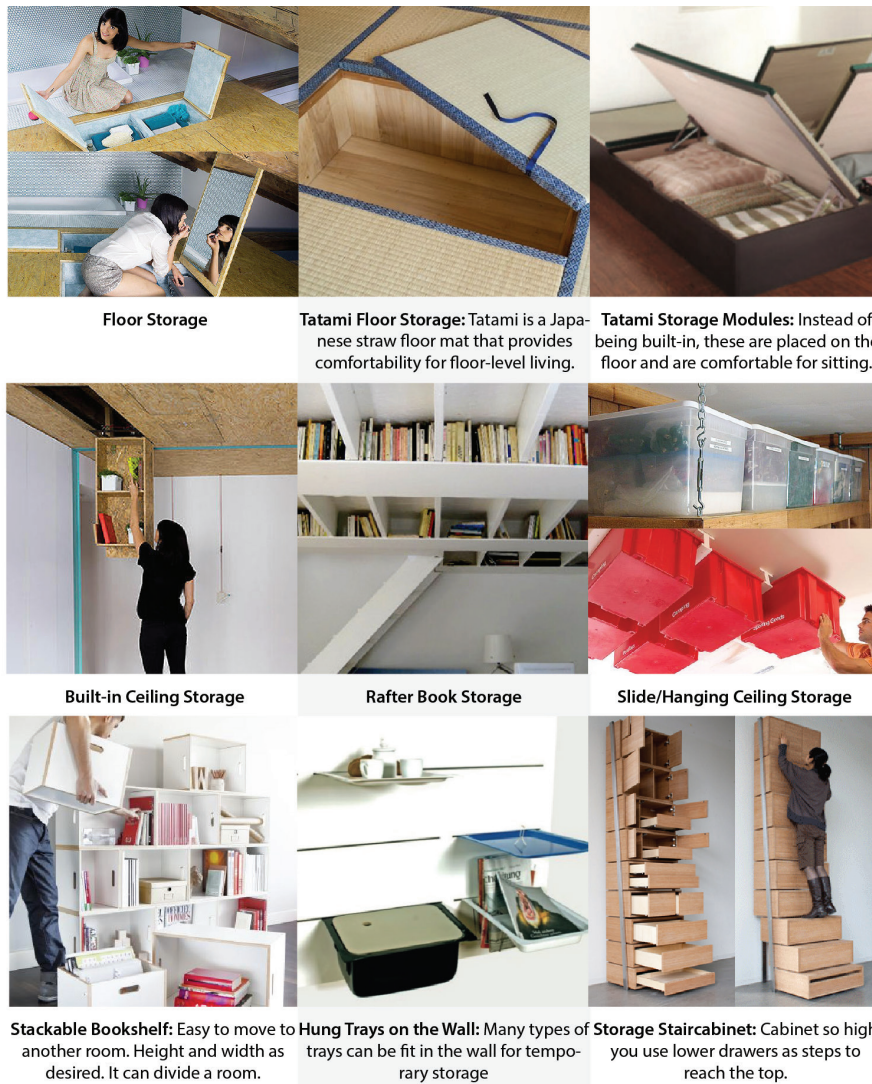


Fig.93 Why would you use these storage? (Author, 2016)

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If you were planning your home remodelling, why would you use or not use any of these solutions?

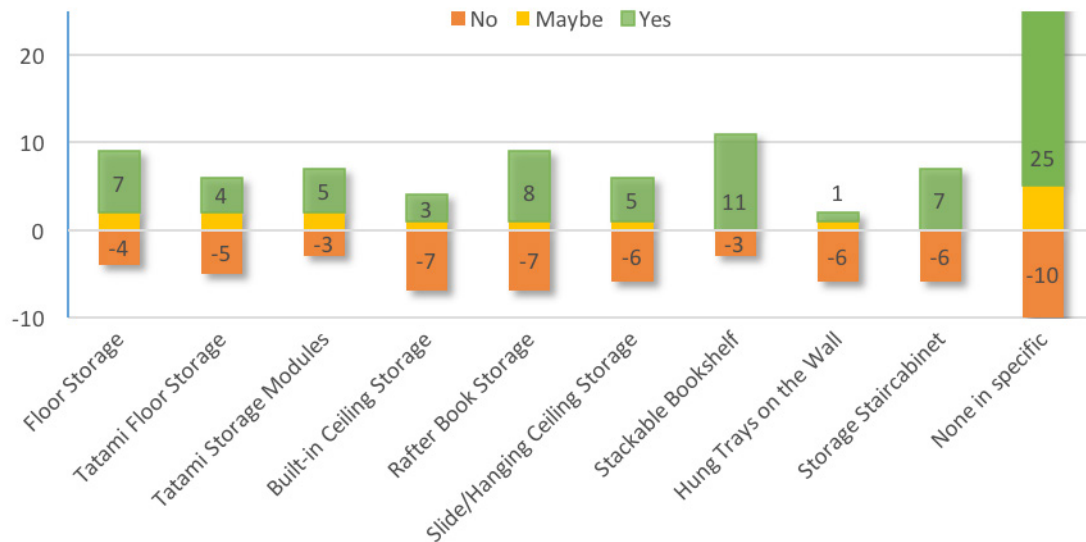


Fig.94 Preference of storage solutions (Author, 2016)

From all of the categories presented, the more accepted space-saving furniture by all respondents was storage furniture. This could be because storage furniture traditionally is only used for storage, which can occupy space without there being a need for that. In another question, about the piece of furniture that they used less in their homes, storage furniture was the most answered, following the dining table and the sitting furniture next.

Do you have a piece of furniture you use less in your home? If so, which one?

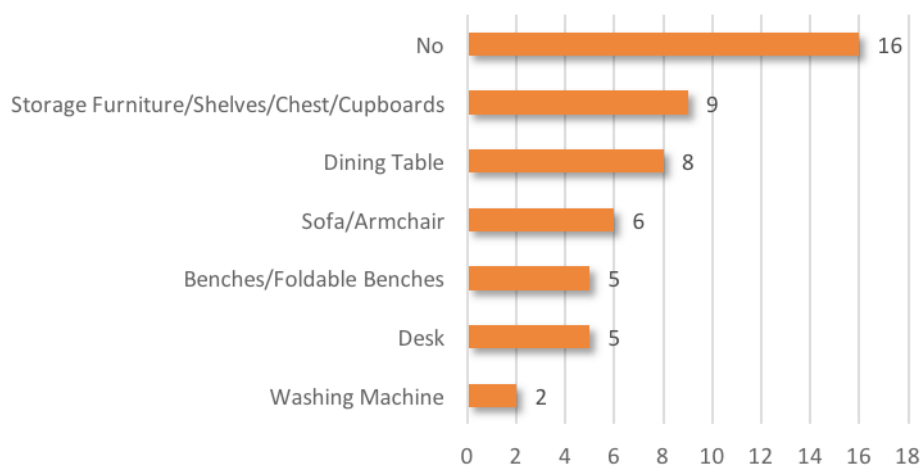


Fig.95 What furniture do you use less? (Author, 2016)

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Among all of the options presented, the most wanted was the stackable bookshelf because it was practical and easy to use. The second most wanted was the rafter book storage because it was pretty. And the third most wanted was the floor storage because it gained space and the storage staircabinet because it doesn't require an extra staircase.

The least wanted options were the built-in ceiling storage because it is tiring to use and also the rafter book storage because it is of difficult access.

The floor storage solutions and the ceiling storage solutions were the most radical, and yet there were still people interested in them. An alternative option to floor storage can be found in the NIHOME concept developed by the author. If there is value in having a risen level to the interior—not only to separate the entrance hall from the rest, but also to gain storage space without sacrificing any space at all—then why not use small square boxes and lay them all around the floors, like tatami mats would be. When there was a need to sunken the floor, one would only have to remove as many boxes as needed. If there was a contrary need to rise an object, like a television, one could also pile up floor-boxes. This solution comes in handy because, for it to work, there would have to be furniture to a minimum. If there were any furniture it would have to be portable to be able to open the floorbox placed under it—and a constantly clean floor so that the interior of the boxes wouldn't get dirty when opening them—the aid of robotic floor cleaners and the lack of furniture makes this very possible.

How much would you like to store things in these places, in order to gain space?

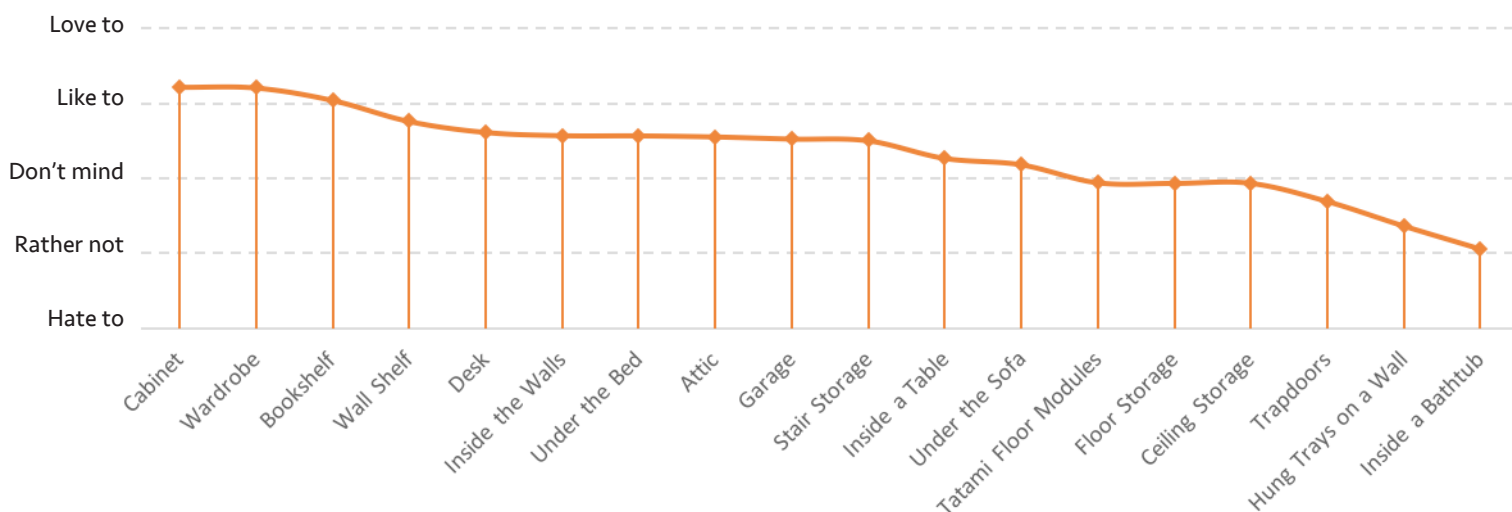


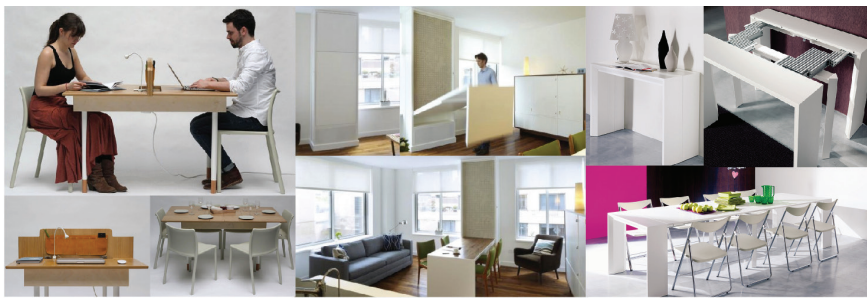
Fig.96 Preference in storage places (Author, 2016)

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When asked where the respondents would like more to store their things in order to save space, the most loved option was the wardrobe, then the cabinet, then the attic. The most hated options were inside a bathtub, by hanging trays in a wall and in trapdoors. Some of the most radical options like floor storage, tatami floor modules, inside a table, inside the walls and ceiling storage, weren't either loved nor hated, they were more liked and wouldn't mind to.

The most important furniture-consuming factor is the need for organization, making tansu—or cabinetry, like we call it—the piece of furniture that occupies most of a Western house. If we can eliminate individual common cabinetry from our house, we're already more than halfway in the path of achieving a minimal house. How then can we manage this feat? If everything we owned could fit in built-in cabinets in every exterior wall, this problem would be solved. But if we reduced the walls to a minimum of probably one or two exterior

walls (if all other walls are glass doors), this still could not solve the problem. From this point on, it would be needed to conduct alternative design solutions, like the ones presented in this thesis, to provide storage places that wouldn't occupy a lot of space and would be easy to clean.



Desk/Dining Table: Double desk that expands to a dining table

Wall/Table: Unfoldable wall that serves as a big dining table

Standing/Dining Table: Small standing table that expands to a 10-seat dining table. Known as Goliath table.



Coffee/Dining Table: Coffee table that lifts to dining height and expands to an 8-seat dining table.

Pull Up Tray: Bedside table with a pull up top that can be used as a tray.

Mirror/Table: Wall mirror or frame that is unfolded to a table still attached to the wall.



Table with Storage: With hidden compartments, it leaves space under the table free.

Kotatsu: Japanese low table over an electric heater with a hanging quilt that retains heating underneath.

Coffee Table with a Bird Cage

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If you were planning your home remodelling, why would you use or not use any of these solutions?

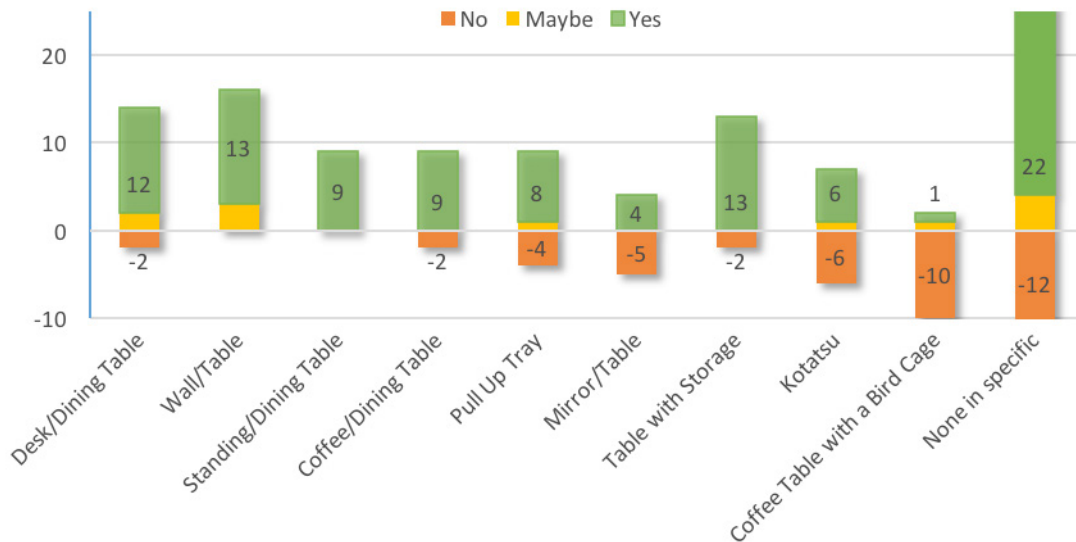


Fig.98 Preference of tables solutions (Author, 2016)

The tables were the second most liked type of space-saving furniture. Between them, the wall/table and the table with storage were the most wanted, and next it was the desk/dining table. All of these were liked because they were multifunctional and saved space that would otherwise be occupied with an additional piece of furniture. Using the dining table as a desk is a very common behaviour that respondents reported to have, but had a downside which was that they had to remove everything on top of it everytime they had

to change the function of the table. This is probably one of the most tiring types of space-saving furniture presented in this survey, and it's surprising that it had that much acceptance. The least liked table was the coffee table with a bird cage because it was considered to be outrageous, unhygienic and useless.

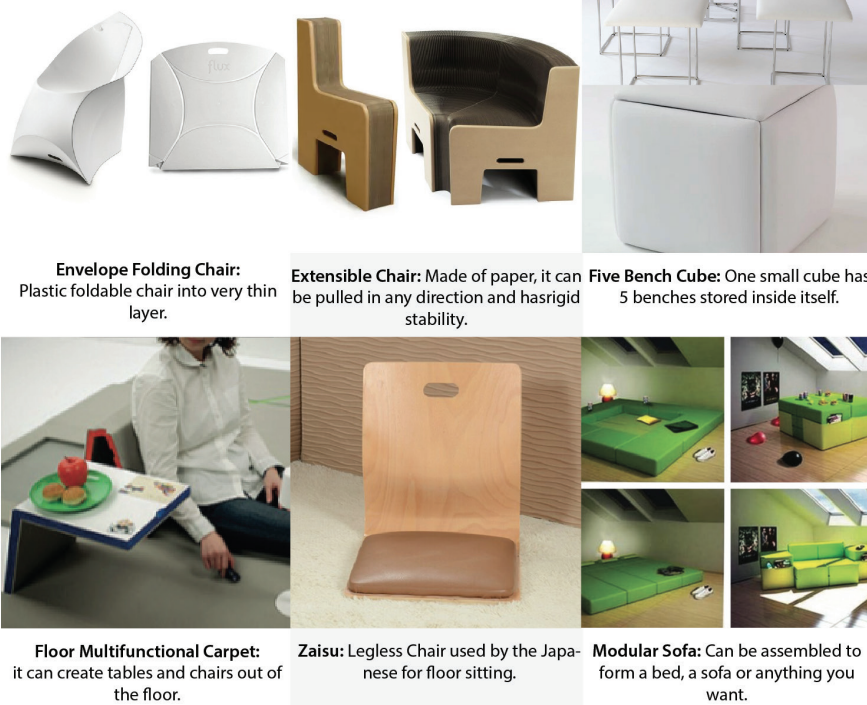


Fig.99 Why would you use these seats (Author, 2016)

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If you were planning your home remodelling, why would you use or not use any of these solutions?

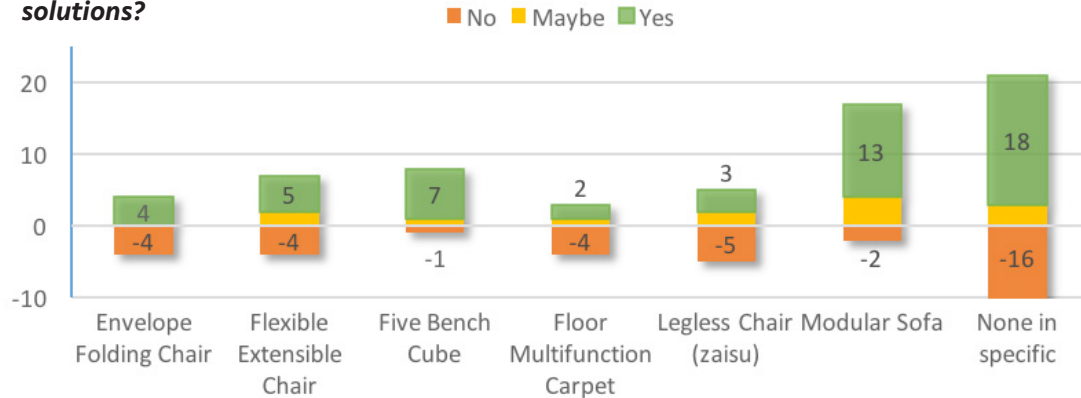


Fig.100 Preference of seats solutions (Author, 2016)

The seating furniture was less well received than expected. The examples were very radical. The most well received furniture was the most normal, the modular sofa. This piece was very much appreciated and we even got contacted back to give information as to where the respondent could buy this furniture.

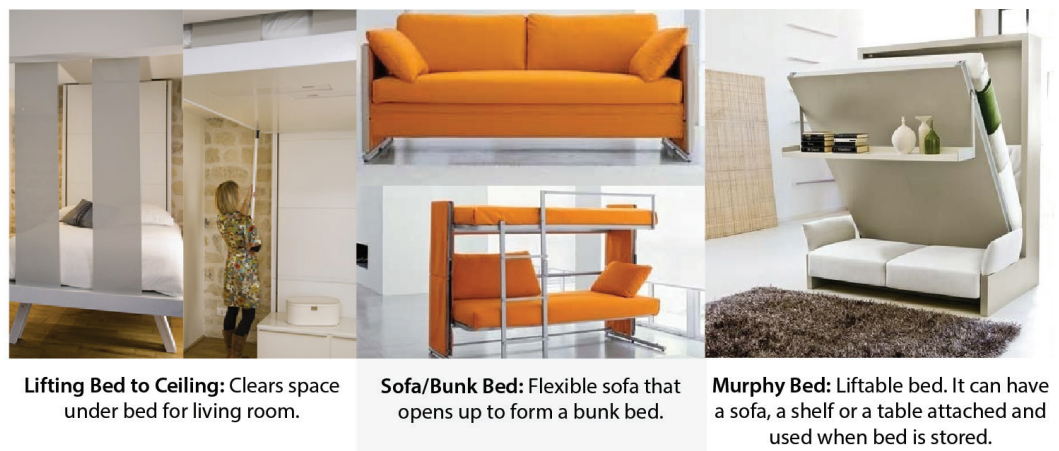
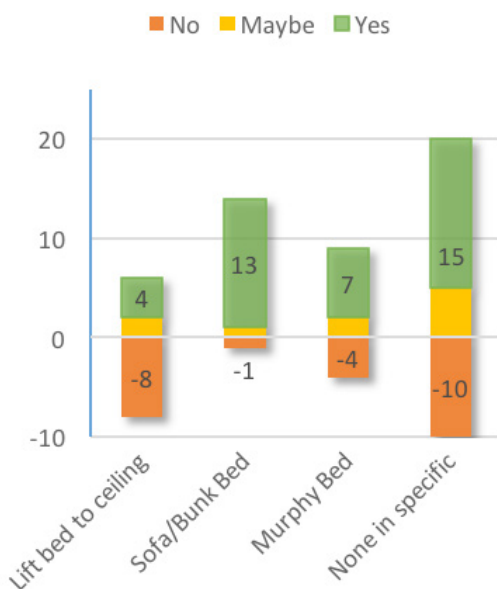


Fig.101 Why would you use these beds? (Author, 2016)

If you were planning your home remodelling, why would you use or not use any of these solutions?



The beds were well received in general, except from the lift to ceiling bed. The Murphy bed seems to be less popular than the sofa/bunk bed. Still, many people reported that beds were very important and had to be very comfortable, so space-saving with the beds was less important than quality and comfort for them. We did not propose any floor level sleeping, but we can assume that the people who didn't like it because they wanted beds to be comfortable, wouldn't want to sleep on the floor either.

Fig.102 Preference of beds solutions (Author, 2016)

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Piano/table: Piano that when closed can still be used as a table.

PingPong/Door: Utilizes space in front of doors to play Ping-Pong.

Dining Table/Pool Table: Pool table that can be used as dining table.

Fig.103 Why would you use these entertainment furniture?

(Author, 2016)

If you were planning your home remodelling, why would you use or not use any of these solutions?

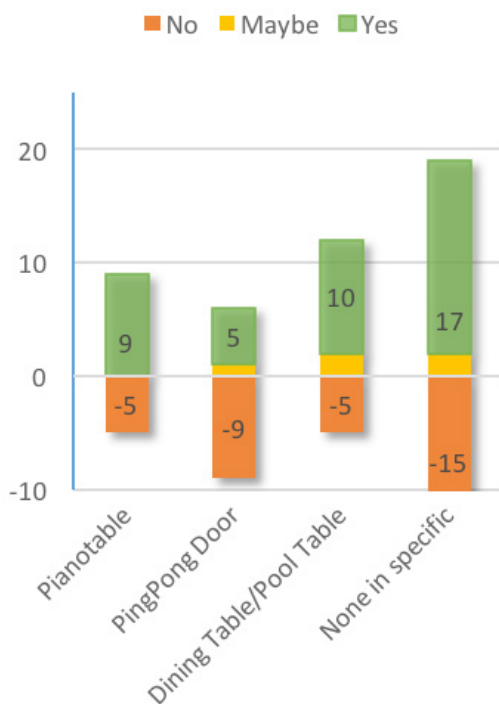


Fig.104 Preference of entertainment furniture (Author, 2016)

The entertaining furniture had an interesting response. Some people were fascinated with the possibility of having fun inside the home without sacrificing any space, but other people were very rigorous with the type of equipment indicated for playing music or playing sports. It's true that a piano should first be a good piano, and only later be considered to be used as something else, but some people thought that this type of furniture was compromising the quality of the most important features. The ping pong door doesn't have the official measurements to be able to play ping pong professionally, but it still is a good option to have fun inside the home when there's no space available for a better sized table. Therefore, people who didn't have space seemed to like every idea, while people who didn't suffer for space, thought that these were useless furnishings.

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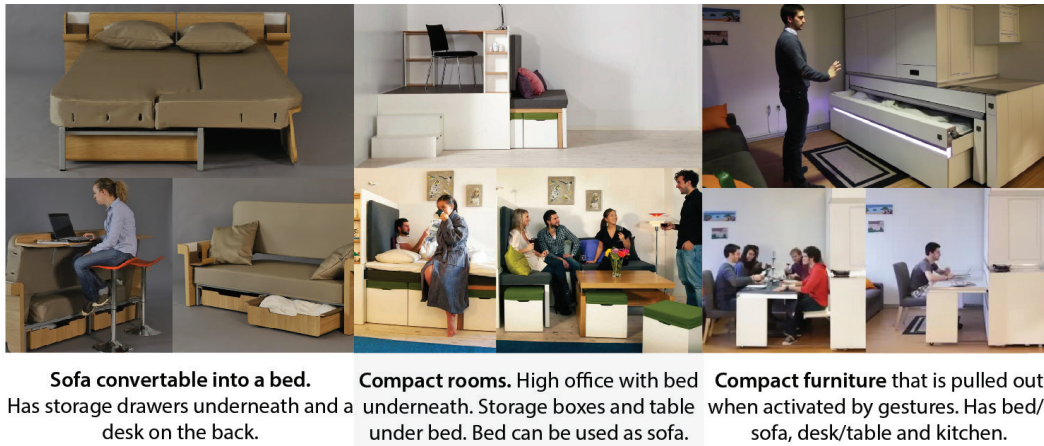


Fig.105 Why would you use all-in-one furniture (Author, 2016)

If you were planning your home remodelling, why would you use or not use any of these solutions?

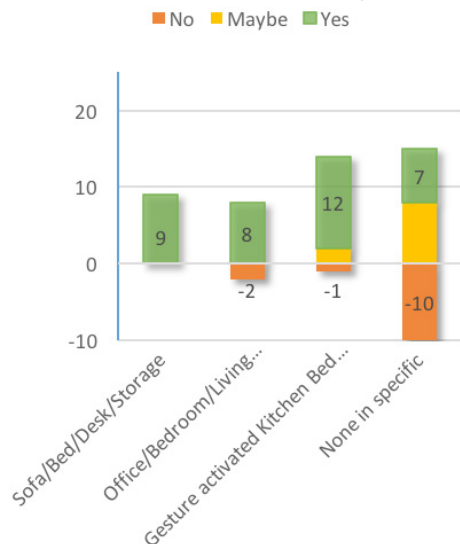


Fig.106 Preference of all-in-one solutions (Author, 2016)

The all-in-one furniture was considered only as a last resort, if respondents really didn't have space and had to live to a minimum. The gesture activated option, is the most technological option and also the most enticing to respondents.

If you were planning your home remodelling, why would you use or not use any of these solutions?

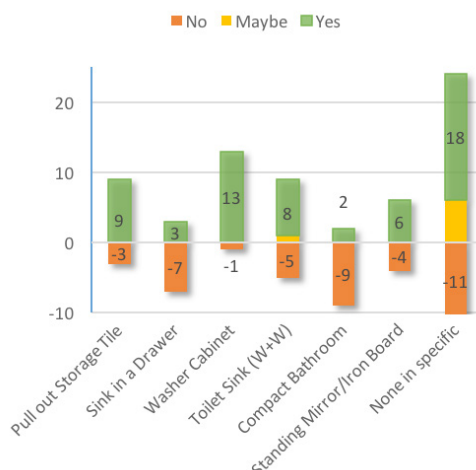


Fig.107 Preference of bathroom solutions (Author, 2016)

The bathroom solutions were very well received by some, for being useful, pretty and saved space. But they were also badly received by some who thought that they were unhygienic, would smell bed and gain humidity, but also that they were fragile and untrustworthy. Some of these options are very rare and unique, and still very under developed. Investing in the bathroom equipment seems to be an interesting and esthetically pleasant solution that could be very well-developed and accepted in the future.

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Fig.108 Why would you use these bathroom solutions? (Author, 2016)

If you were planning your home remodelling, why would you use or not use any of these solutions?

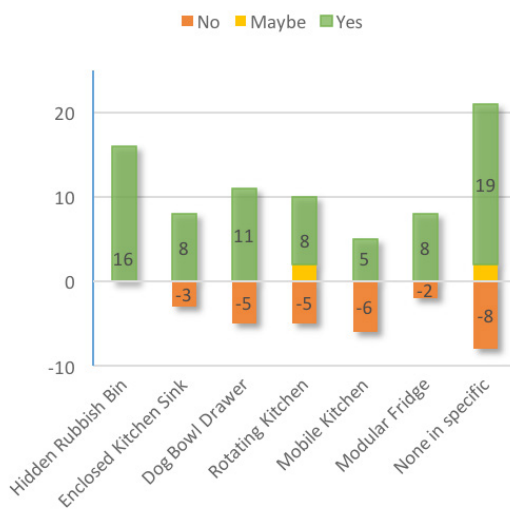


Fig.109 Preference of kitchen solutions (Author, 2016)

The kitchen furniture had even more praise than the bathroom furniture. It was the one that had more good responses and reactions. The majority of the options looked well developed and thought out, and that made a big difference when comparing to the bathroom options. The kitchen has so many needs that it can certainly have room for improvement and people are very open to new solutions.

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Fig.110 Why would you use these kitchen solutions? (Author, 2016)

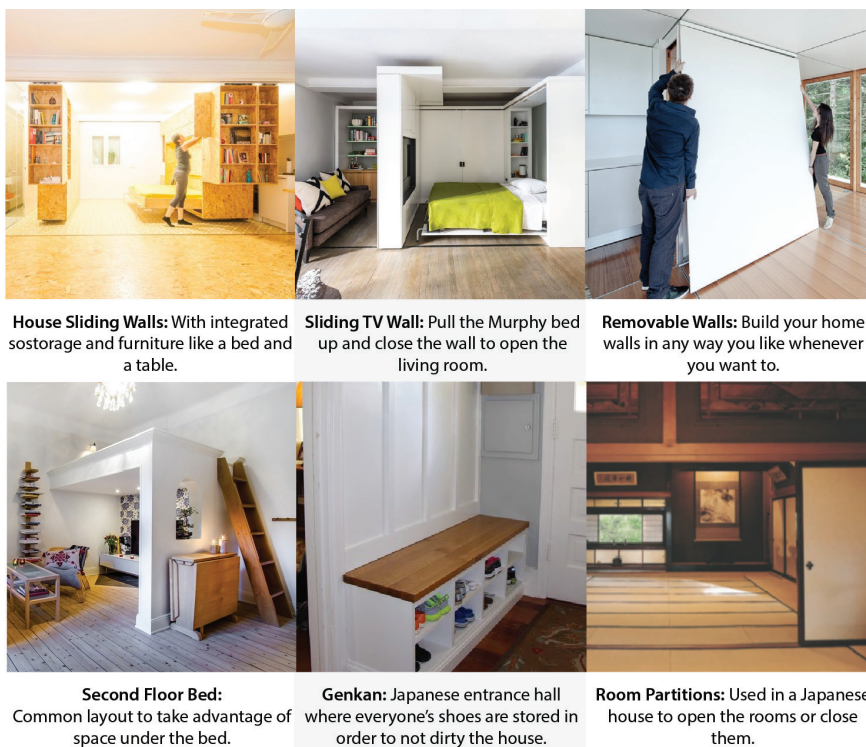


Fig.111 Why would you use these layout solutions? (Author, 2016)

Lastly, we presented layout solutions for the home, and generally speaking, they were openly received. The most liked options were the second floor bed, an option with a lot of online spread and common in the USA, and the genkan. From all of the Eastern house differences, the genkan was by far the most wanted trait by Western respondents. The home sliding walls and room partitions were also well received. From every option presented in the survey, the house sliding walls were the most preferred. These were the most radical changes possible. Getting rid of our walls and giving flexibility to the walls of our homes is one of the best options for people who want to be able to do much more activities inside their homes.

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If you were planning your home remodelling, why would you use or not use any of these solutions?

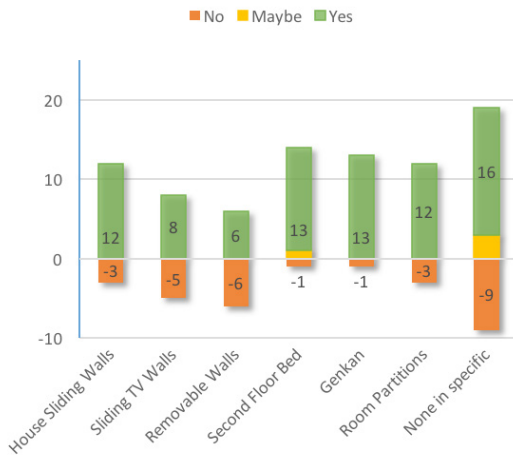


Fig.112 Preference of layout solutions
(Author, 2016)

When asked what the respondents liked or didn't like about flexible walls, most answered that they liked how they could open the house into an open space, and how they could add or close a room for different purposes. What they didn't like more was how some thin walls have little auditory privacy. Mostly, they recognized more benefits than disadvantages in flexible walls. This is by far the most ambitious and life-changing option for improving our homes, which if done correctly, could benefit the lives of everyone, either the people who have to live in very small houses, or the people who have big houses but can still adapt them to their needs throughout life.

What do you like about the idea of flexible walls?

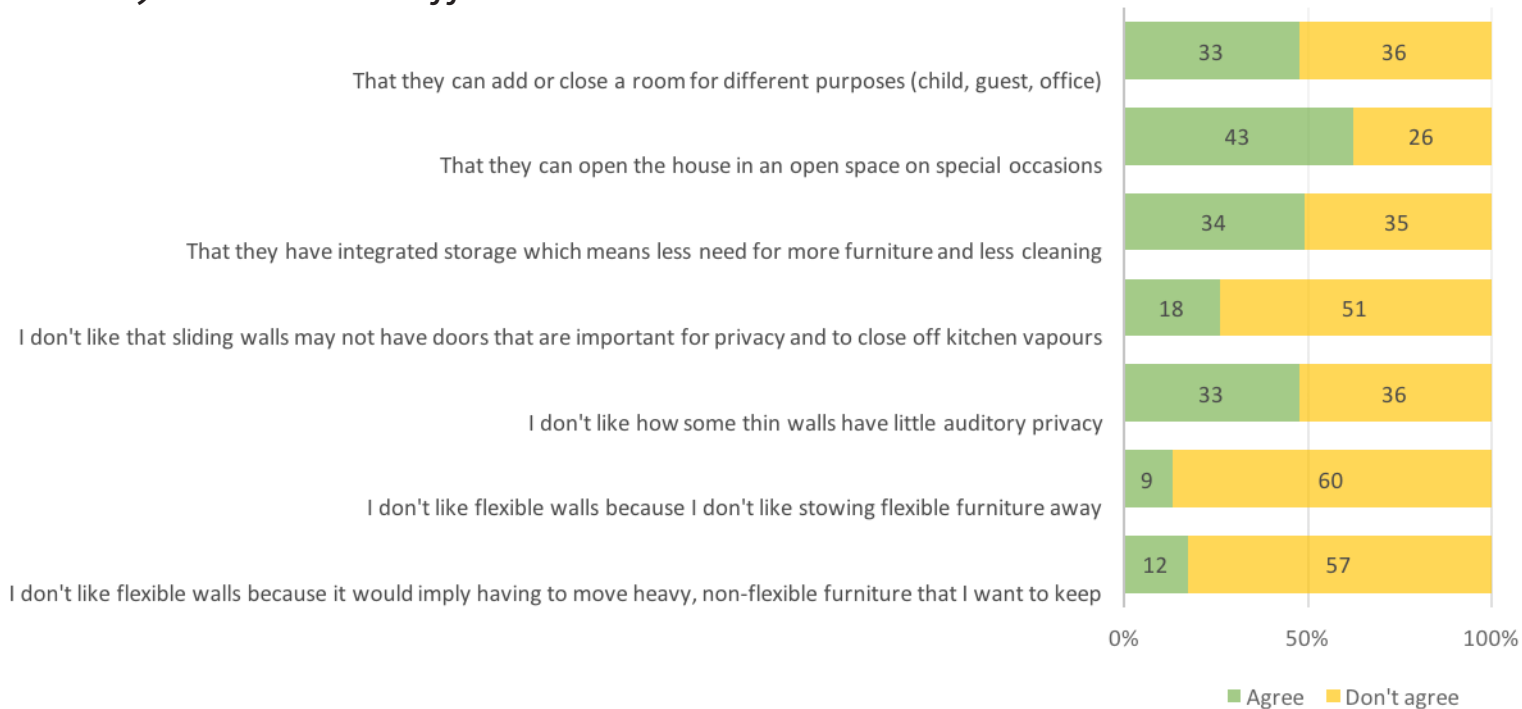


Fig.113 What do you like about flexible walls? (Author, 2016)

19 | SURVEY RESULTS

Respondents had to choose between having a flexible or permanent certain type of furniture and they chose the bed, bathtub and sofa as the permanent types of furniture, while they chose the entertainment furniture, guest beds and small kitchen appliances to be transient.

How would you like your furniture to be? Decide between wanting the furniture to be ready to use at all times, or stowed when not needed

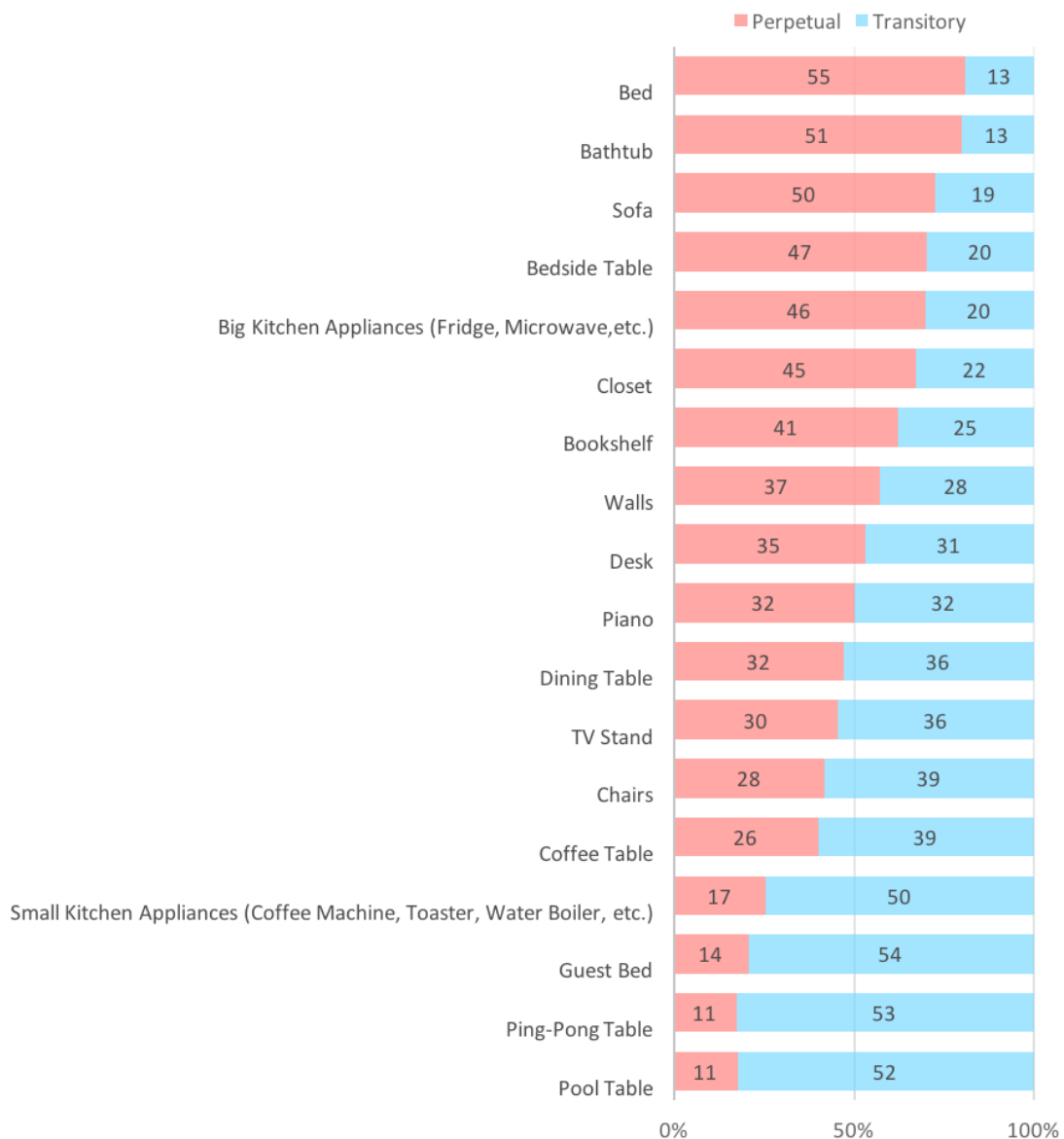


Fig.114 Perpetual vs. Transitory furniture (Author, 2016)

20 | CONCLUSION

As our world population grows, our cities become more populated, space becomes more expensive and economic classes grow in difference, the quality of life and living conditions for the poorest people, has decreased in overpopulated areas. The ambition for economic international competition makes big cities invest in more ways to bring even more people inside. If we don't pay attention to the initiatives for building smaller real estate, keeping it in control, we may end up sacrificing our current affordable space. While we struggle with these issues, we should consider innovative living quarters, different living customs, different house layouts, and keep our mind open so that we can enjoy life and people with as little constraints as possible.

Compared to the Eastern living habits, the Western culture seems to be too attached to furniture, too attached to immediate comfort, too lazy to take advantage of space by making it flexible, and too overwhelmed with household chores. It seems to be inevitable, though, that in time, when our cities become even more overpopulated, the population will embrace flexibility in order to be able to do more inside the home. Although maybe not necessarily with the bareness of space and lack of furniture. The furniture that is being developed to solve space problems, continues to satisfy the Westerner need to have almost ready to use furniture. Almost like a compact version of multiple furniture combined together into a bigger piece of furniture that you can rotate and open when you need a specific furniture. This appears to be the difference to the Eastern customs, where the furniture is usually small, portable, storable when not needed, instead of being compacted into other furniture for a more ready-to-use option. There are advantages and disadvantages, like not having almost any effort to produce a table or a bed, but at the same time, not being able to separate the bed from the table or place it in some other spot in the house, or accommodate it to the number of guests you are receiving.

Although this is the larger view of the Western consumers and the Western furniture design industry, through our online survey we were able to identify significant public that is open minded and wouldn't mind trying different living habits.

Furniture design can indeed aid with lack of space and unflexibility of rooms. It can improve quality of life for overpopulated areas but not without sacrificing the current minimum standard. For the poorest population, the ones who could benefit more from improvement, it is ironically mostly an unaffordable option. For the average population, it is a solution for taking advantage of space as needed throughout life, for example, by using the space of your son's rooms, when they have left, to create a larger room for a different purpose. Raising a family would be less of a problem in one family home, because the number of rooms could be created when needed. And also, it is a guaranteed way for hosting more parties and having more guests sleep over.

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